Volume 60

American Machinist

New York, January 31, 1924

Number 5

Ruling 15,000 Lines Per Inch

By Frank A. Stanley

With foreword by Dr. J. A. Anderson, Physicist

Machine for ruling gratings and how it was built—Lapping lead screw to correct errors—Testing corrections with interferometer

Foreword:

IT IS well known that white light is in reality a mixture of light of all colors. A beam of white light falling on a glass prism is separated into its constituent colors as shown in the diagram *A*. The colored band *RYGBV* is called the "spectrum" of the source *S*, of white light, and the action of the prism may be described by saying that it forms a "spectrum."

There is another way of forming a spectrum, which is illustrated in diagram *B*. Here *G* is a metal plate

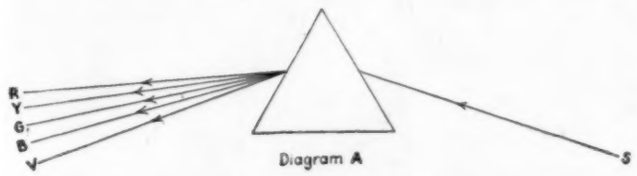


Diagram A

called a *diffraction grating*. Its polished surface is ruled with a large number of fine parallel straight lines usually from 10,000 to 20,000 per inch. White light from *S* falls on the grating, where the following takes place: A portion is reflected as white light in the direction *G0*. Other portions are reflected in the directions *G1* or *G2* as spectra, the arrangement of the colors in each spectrum being as shown. The spectra marked 1 are called spectra of the first order, while those marked 2 are called second order spectra.

In general, it may be said that the spectrum given by a grating is in many ways superior to that given by a prism, and, in modern times, when the study of spectra is so important in physics, astronomy and other sciences, there is a steadily growing demand for gratings of the highest quality.

The manufacture of a grating which shall be good enough for the modern scientific investigator is perhaps the most difficult task ever faced by man. Some idea of the difficulty may be gained from the following specifications for a 6½-in. plane grating:

1. The ruled surface is to measure 4x5 in. and it shall consist of 75,000 lines, each 4 in. long.

2. Each line must be so nearly straight, that the maximum deviation from absolute straightness shall be less than $\frac{1}{1,000,000}$ inch.

3. The spacing must be so accurate that no line must be "out" of its ideal position by more than $\frac{1}{1,000,000}$ inch.

4. All the lines must be accurately alike in shape, that is, the width, depth and form of groove must be the same for all.

The above conditions are not arbitrary in any sense, for they are deduced quite simply from the natural law of optics, and furthermore, they are minimum conditions. Larger errors than those specified would not only be troublesome, but for some purposes they would render the grating quite unfit for use. Another way of putting it, is to say that the above conditions are based on a "factor of safety" of 1; if a factor of safety of 5 is demanded, the tolerance in Nos. 2 and 3 would have to be divided by the square root of 5 so that instead of $\frac{1}{1,000,000}$ in. we should read $\frac{1}{2,236,100}$ inch.

Since about 1880, a few machines capable of ruling high quality gratings have been constructed. It must

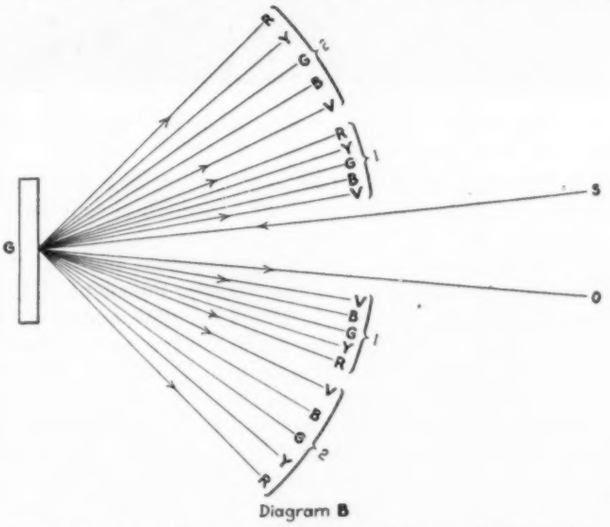


Diagram B

be understood, however, that even these highly perfect machines do not always make a perfect score. Failures are quite frequent.

Here is a general description of the largest of these machines which belongs to the Mt. Wilson Observatory. Work on it was started in 1913.

THE machine for ruling gratings must be capable of operating with the utmost degree of precision. It must be so designed and so erected as to assure permanency of position without possibility of vibration or deflection. Its moving elements must be constructed to reduce the effects of inertia to a minimum. Its position must be such that the surrounding temperature may be controlled to a fraction of a degree during the period of operation. The feed screw and actuating mechanism for determining the spacing or distance between lines ruled on the grating, must be of such refined character as to assure absolute uniformity of spacing throughout the entire series of lines on the block. The ruling medium, a diamond, must be so shaped and operated as to provide for the full retention of its original cutting point and the uniform ruling to depth and form of all lines on the grating. These lines may number 90,000 all told, and the cutting may mean the continuous operation of the diamond throughout a period of between 70 and 80 hours.

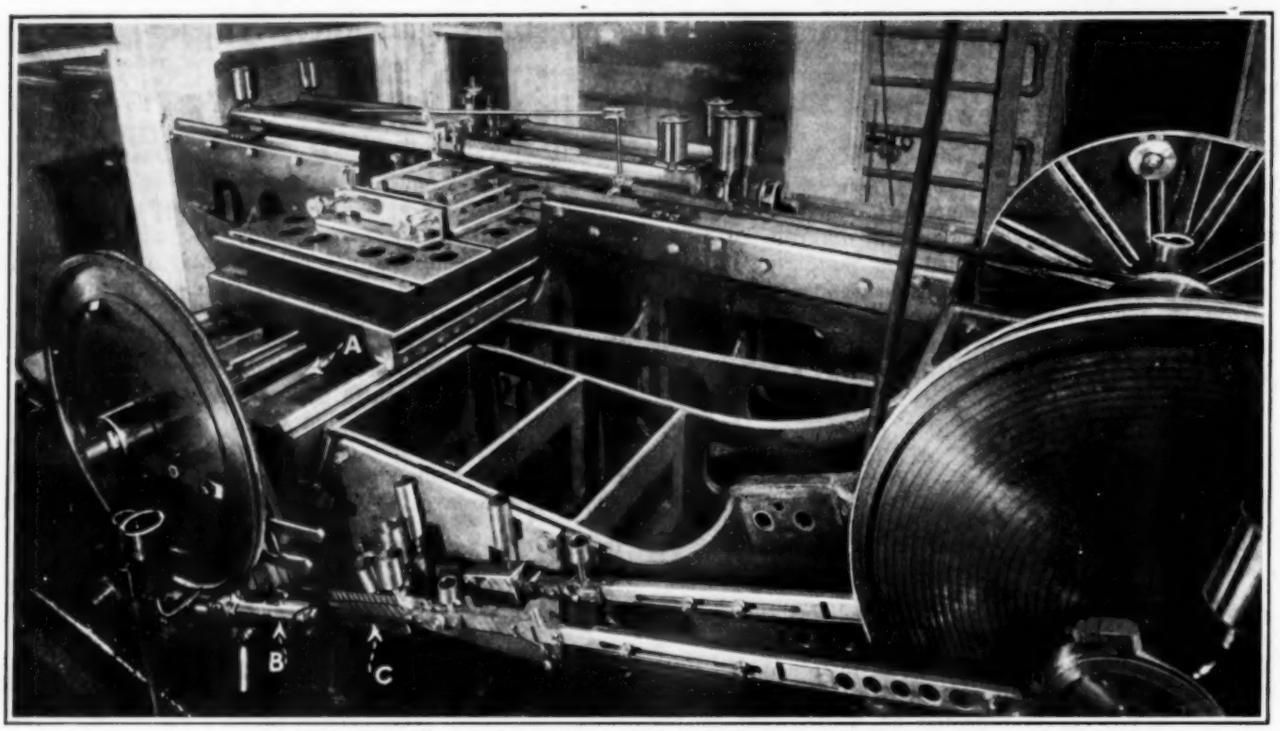


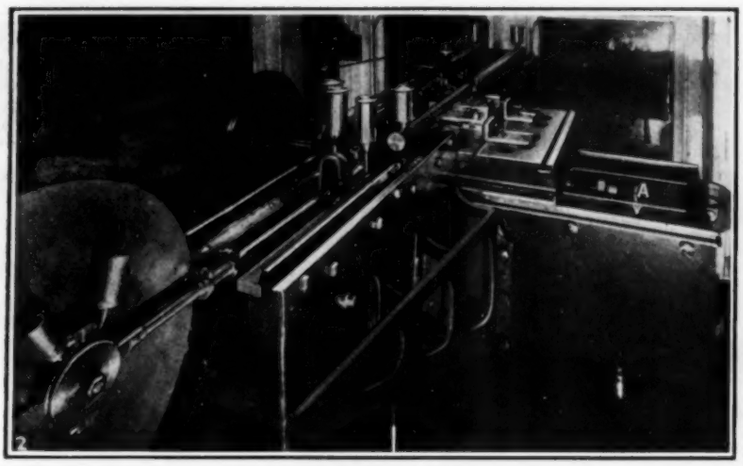
Fig. 1—Grating ruling machine of the Mt. Wilson Observatory

General views of the ruling machine built at the shops of the Mt. Wilson Observatory, Pasadena, Calif., are reproduced in Figs. 1, 2 and 3. The machine embodies features of refinement of design and precision of workmanship, difficult to describe with any measure of completeness. It represents the combined experience and efforts of men of many years of specilization in the production of the finest types of scientific instruments, and, in itself, required several years of experimentation and development before it was finally brought to completion in the form illustrated.

The machine is now in operation at the laboratory of Mt. Wilson Observatory, Pasadena, Calif., which has been under the direction of Dr. W. S. Adams since the recent retirement of Director George E. Hale. This machine has been carried through to perfection under the immediate supervision of Dr. John A. Anderson, formerly physicist at Johns-Hopkins University, and Clement Jacomini who has devoted many years to the construction of precision work of extreme refinement.

The general proportions of the machine as a whole are well brought out by the views referred to in a preceding paragraph. Its location is in the sub-basement of the laboratory where, mounted upon massive concrete foundations, it is secure against surface vibrations. It is enclosed in glass lined walls, where its operation may be watched from without. The temperature within the glass walls is mechanically controlled to within a limit of one-half degree variation over a week's time, through the medium of a water circulating system provided with automatic regulation. The coils for the temperature control system may be seen suspended on the walls of the concrete pit in which the glass operating house is constructed. The arrangement gives ample passage room for the observer at any point around the machine room, and every detail of operation can be watched without the necessity of entering the glass enclosure at any time during the process of ruling the grating, which requires between three and four days.

The ruling machine bed is in the form of a heavy cross, the longitudinal member of which is provided with inverted Vs for reciprocation of the slide carrying the cutting diamond, while the cross portion of the bed is similarly provided with Vs for mounting the work table which advances the grating under the diamond point. The reciprocating action of the ruling head or slide upon the longitudinal ways is derived from a connecting rod, operated by a crank pin or eccentric adjustably secured to the face of the slotted disk shown at the left of Fig. 2. The feeding or spacing motion of the work table, which advances the grating blank for each successive line to be ruled, is accomplished by means of worm gearing, the worm being actuated by a device operated from the eccentric rod at the side of



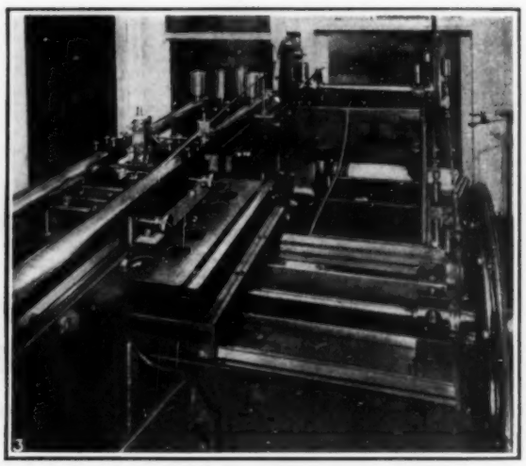


Fig. 2—From the crank end. Fig. 3—Close view of ruling carriage

the driving wheel or disk. The drive is by a small round belt in a groove around the disk.

The carriage for the diamond is composed of two short sections accurately fitted to the longitudinal Vs of the bed and connected by two hollow shafts, which carry the cutting head and diamond holder. The carriage for the work is of massive section, and its weight is taken almost entirely by chambers of mercury, one under each side of the table, as may be seen at *A*, in Figs. 1 and 2. The support thus provided leaves but a few pounds total weight on the ways of the cross slide, with a minimum of resistance from the heavy slide and auxiliary members.

The worm wheel for operating the cross slide is about 22½ in. in diameter and has 1,200 teeth. The circular pitch is 1½ mm. The worm diameter is 46 mm. and is of the Hindley form. The lead screw for operating the cross slide is 70 mm. in diameter, one meter long on the thread and the thread itself is 52 deg. included angle, having a lead of 2 mm. The nut is 22 cm. long (about 8½ in.) and is split. The nut body is of steel with babbitt-lined thread sections inserted in the shell.

The grating to be ruled is a polished blank of very hard alloy which is more difficult to cut than a glass plate. Yet the diamond must stand up to its work for nearly one hundred thousand lines before the individual task is completed. That is, on a grating 6 in. wide and having 15,000 lines to the inch, there would be 90,000 such lines on the face of the one plate. During the ruling of these lines there must be no touching or adjustment of any part of the mechanism, nor must the work be stopped.

The diamond has to be lapped to a definite shape, determined by the character of the ruling desired. The angle of slope at each side of the cut (if we may thus refer to so shallow a line as a cut) is fixed by the type of grating required, and the purpose to which it is to be applied. The diamond is lapped accordingly, and the clearance angles finished by the use of a special lapping device with which exactness is secured. The diamond holder is inserted in a carrier on the traversing carriage, and the holding device is so arranged as to have a relieving action on the return stroke. A careful series of experiments has determined the best type of diamond to use for this work, as well as the most suitable angles for permanency of the point.

The wormwheel for operating the lead screw which feeds the work table under the diamond carriage, has 1,200 teeth. The lead screw has a pitch, expressed in fractions as 0.07874 in. The worm makes exactly one turn in feeding for each line to be ruled. Therefore the advance of table and work for each movement is 0.07874 ÷ 1,200 or 0.0000656 in. Obviously the cross feeding mechanism for giving this minute spacing must be very accurate. The lead screw must be uniform throughout the working length; the screw must be straight and concentric with its pivot bearings; all

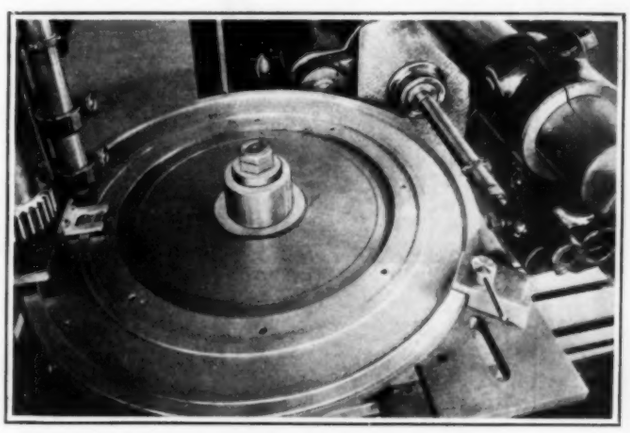


Fig. 4—Gashing the worm wheel

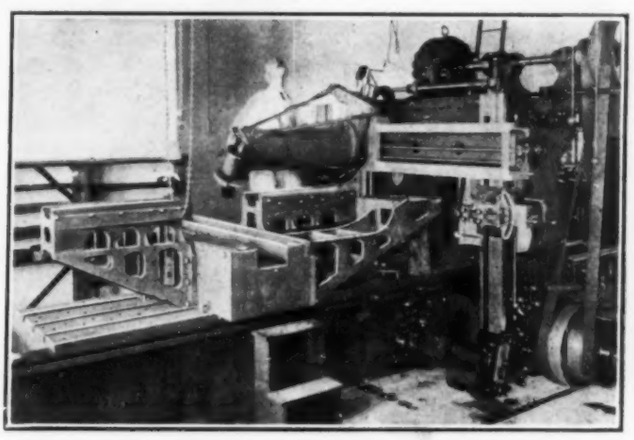
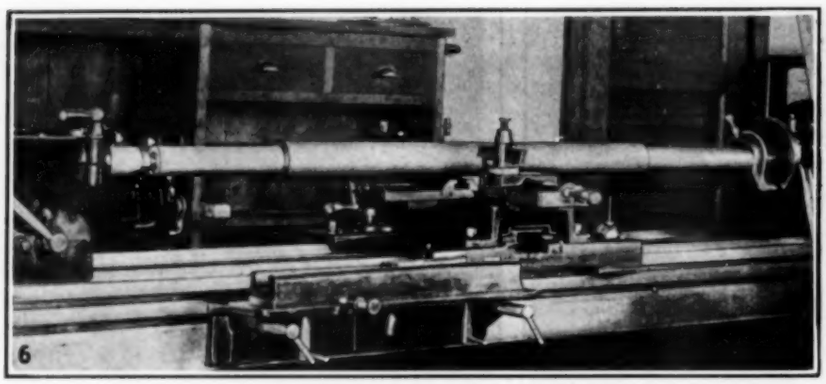


Fig. 5—Grinding the ways



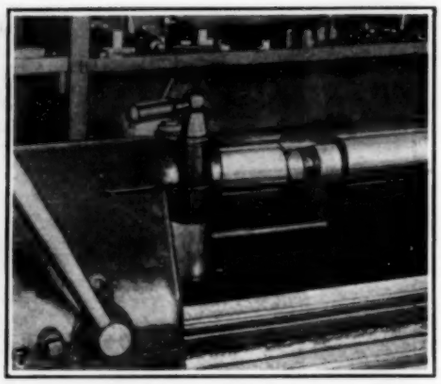


Fig. 6—Cutting the lead screw. Fig. 7—Threading the nut and lap

possibility of end play or back lash must be eliminated before the machine starts its ruling operations; and the wormwheel must be given a definite degree of advance at each revolution of the worm, at least within very close limits.

The gashing of the worm wheel, is shown in Fig. 4, which illustrates the method of setting for each cut, by means of a powerful microscope clamped over a vernier reading to a finely graduated ring on the upper face of the wormwheel. Following the gashing and hobbing operations on the milling machine, tests were made of the accuracy of the tooth spacing, by mounting a transit on the wheel, and sighting on a distant point on the mountain while the wheel was indexed by its worm.

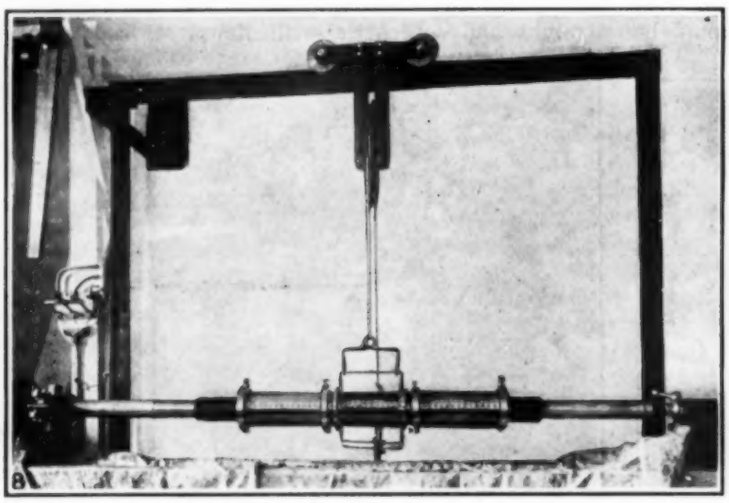
The operation of the worm and wheel on the ruling machine is accomplished by means of a peculiar type of cam mounted on the worm shaft. This cam can be seen at *B*, Fig. 1. It is in the form of a small sleeve with a spiral slot or channel which has a gradually accelerated pitch at the starting end, and a similarly retarded rate at the stopping end. This construction enables the worm to start from a fixed position at a gently increasing rate of speed, and to diminish its speed of rotation at a corresponding rate when it approaches the completion of its full revolution.

The cam is actuated by a form of cross head or slide, *C*, from the eccentric rod shown in Fig. 1. The function of this rod together with that of the auxiliary rod on the inner side of the wheel, is to rotate the worm and lock it upon completion of the indexing movement.

Some of the methods used in machining the various parts, including the screw and nut, are shown in Figs. 5 to 9, which also show some of the tests applied to these members. The method of finishing the longitudinal ways on the bed is shown in Fig. 5. The planer was equipped with a special head and extension arm for grinding the angular sides of the Vs.

To many mechanics the most interesting part of the work on this machine is the method of cutting the lead screw and nut to the requisite limits of accuracy. It should be said at the outset, that in planning the system of producing these threaded members, it was not the intention to worry about making a lead screw of some definite exact lead, but rather to produce a thread that should be exactly uniform in its lead from end to end. If this lead were slightly longer or shorter than some definite pitch, it would make no difference in results so long as the lead from thread to thread was exactly the same throughout the total length of the screw. Provision was made in the design of the machine itself for offsetting the effect of a lead screw that was either too long or too short in its total lead, as the case might be.

This compensating feature consisted in applying controlling wings or arms to the feed nut under the work carriage, with a pair of parallels or straight-edges secured to the inner walls of the base housing. The straight-edges were adopted to provide a guide for the controlling arms on the nut. If the lead screw had



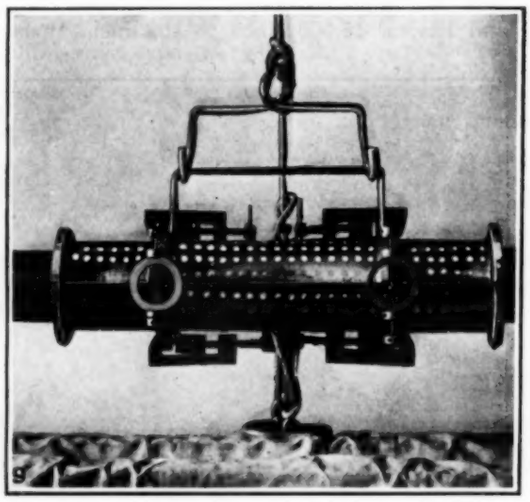


Fig. 8—Method of suspending the lap. Fig. 9—Details of lap support

happened to come long or short in its final finishing process, the straight-edges would have been set slightly out of parallel with the axial plane of the screw. Then as the table was traversed, the nut on the screw would have been rotated either forward or back to compensate for the over-all discrepancy in the lead of the screw. This differential action, however, has not been required to be put into effect, for the accuracy obtained in the over-all length of the screw-thread lead was such that the straight-edges were set parallel to the screw axis, merely to hold the feed nut against turning.

The lead screw is shown in the lathe in Fig. 6. The stock used for the screw was tap steel which had been carefully annealed and centered.

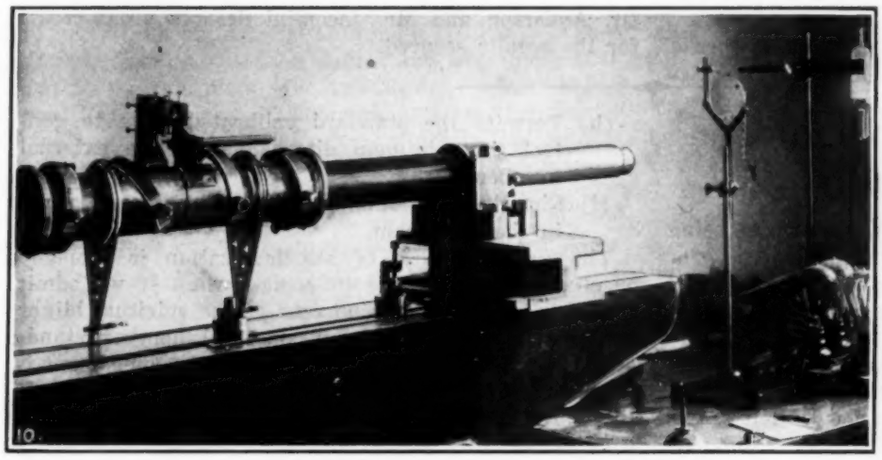
In threading the screw, it was taken for granted that in the cutting process there was bound to be a slight error in the thread somewhere. Measures were taken for duplicating this error, whatever it might be, throughout the length of the screw, so that the uniformity of the errors in duplication would facilitate the rectifying of the entire piece of work. For instance, consider a straight edge or parallel which must be finished to as truly a straight surface as possible. If the several errors in the work are uniform, it is far easier to lap and scrape the job to a correct surface than if each high spot is at variance with all the others.

A screw thread is, of course, simply an inclined plane —a straight edge wound around a cylindrical core. By any known means of cutting there is sure to arise some error in lead, slight or serious as the case may be. In this case the most minute error that the mind can conceive would ruin the screw for its purposes, unless some method were found for finally eliminating that error. So, to repeat, it was decided to throw any inherent error into repeated errors, and then wipe them all out in the process of lapping.

At the outset, threading tools were used at front and back in roughing down the thread. As the intention was to finish by lapping, and, as lapping is not as free a cutting process in the bottom as at the top of a wedge-shaped thread, it was decided to shape the thread with two distinct angles. First a 60-deg. threading tool was used, cutting part of the depth, then following with a 45-deg. tool and threading practically to depth. This left a slightly "bulged" effect near the center of the V-slope on the side of each thread, at the point where the lap would be most effective in reducing it to a true angular surface, thus simplifying the final lapping of the screw to its desired angle of 52 deg. The angle of 52 deg. was adopted because of its coming half way between the two angles of 45 and 60 deg. and lent itself admirably to the method adopted for finishing.

Distributing Lead Screw Error

As the screw approached the point where final threading cuts were to be made, each cut was taken after one of the gears in the translating train had been slipped out of mesh with its fellows and again slipped in place one tooth ahead of the former position, thus rotating the lead screw slightly in relation to the lathe spindle and to the screw being cut. The effect of this procedure was that any local error in the lathe lead screw would thus be duplicated clear around the work with each successive change in position of lead screw gears and the corresponding passage of the threading tool along the job.



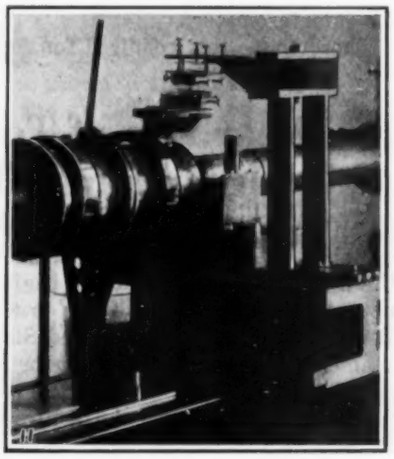


Fig. 10—Testing lead screw with interferometer. Fig. 11—Testing concentricity of screw

The making of the combined nut and lap is illustrated by Fig. 7; that is the threading of these members is here shown. Prior operations consisted of boring, turning and splitting the steel sleeve and fitting its two halves with a series of babbitt inserts which were fastened by screws and dowels. After the inserts were in place, the threading was accomplished, as in Fig. 7, with a bar placed between centers, and the work carried in special holding fixtures made up of wood blocks in pillow block form, secured upon the lathe carriage.

The threading was done in practically the same manner as adopted for the screw described above.

The lapping operation, Figs. 8 and 9, is a typical undertaking of this character at the laboratory. Fig. 8 shows the manner in which the job was supported by sling and counterbalance to overcome the weight of the lap, and so prevent the work from sagging and becoming inaccurate during the lapping process. The appearance of the lap on the work is best presented by Fig. 9, which also shows distinctly the method of arranging the sling details.

Under this method of lapping, the thread of the screw was finished to a remarkable degree of precision,

as determined afterward under tests. Two of these tests are shown by Figs. 10 and 11. It should be noted here that after using the lap for finishing operations, it was cut in two parts lengthwise, and one half thus formed was used as the permanent feed nut for the ruling machine.

In Fig. 10 the two halves of the nut or lap, are being applied to the testing of the accuracy of lead of the screw. The screw is mounted in suitable bearings and the two portions of the nut are provided with arms to rest against the edges of the testing bed and so prevent the nut from turning. The nut portions are a thread or two apart on the screw. Each section is fitted with an interferometer testing element, and, as the screw is rotated, the most insignificant inaccuracy in the lead would draw apart or close the nut halves correspondingly. While this discrepancy might be due to a deviation from accuracy in the lead screw amounting to less than the one-hundred-thousandth part of an inch, still such inaccuracy would be discovered by the interferometer.

There was a test required for concentricity of thread about the screw axis or its bearing pivots. If, in operation in the ruling machine, the screw should run even slightly out of truth about its axis, this would set up an error more serious possibly than any likely to be found in the lead of the thread. The test for concentricity is therefore an important one, and was performed as in Fig. 11. Here the nut is shown with an interferometer element carried upon the outside, while the lead screw is mounted to rotate in the V-blocks. An interferometer is mounted upon a fixed standard on the bed of the testing machine and as the screw is rotated by hand, the nut, being held against rotation, will be moved up and down with any eccentricity of the screw in relation to its bearings. Such movement, no matter how minute, would be revealed by the interferometer.

These very accurate operations, interesting in themselves, are doubly so when we consider that the work was done in an isolated shop, without the many resources of a great manufacturing organization. Both Dr. Anderson and Mr. Jacomini deserve great credit for the results secured.

Wear Life of Tools and Interchangeability

THE wear life of a tool depends, all factors being alike in each case, on the amount the tool is over the minimum hole size at the beginning of its life, and not on the relation of the size to the basic or standard. It is the practice in the United States to make all solid reamers slightly over basic for wear life, and not exactly standard, as some British engineers suppose

In interchangeable manufacture in the United States it is the predominating practice to use adjustable reamers, returning them to the tool room for correction as soon as the standard plug gage will not enter the holes. Years of experience have taught us that this procedure maintains accuracy and quality of holes at a low cost, at the same time enables us to transfer the skill of a good tool maker through the tool room to the machine operators, and best of all provides for strict interchangeability.

My experience, covering thirty years of active work in connection with both the making and use of tools for accurate manufacturing by all of the systems in use during that time, leads me to believe beyond question that the Unilateral System of tolerances has the following proven advantages:

(a) Provides the only practical means of maintaining strict interchangeability in manufacture.
(b) It is more economical to manufacture by this system due to its simplicity.
(c) The gage cost is less.
(d) The cost of dimensioning drawings is less.
(e) The mental effort of dimensioning drawings is less.
(f) Tolerances may be changed without destroying the zero point at which interference takes place. Changing the position of this zero point may prevent the assembly of parts already made.
(g) Permits the standard calibrated gage to settle any controversy regarding the interference of metal between mating parts.
(h) Permits the standard calibrated gage to control the minimum dimensions of the external member.
(i) Simplifies the handling of small tools and gages in the tool room.

The great purpose of standardization is economy or elimination of waste in some form. If we admit this then we need have no fear of the spiritual blight that standardization may produce. Whenever standardization does not effect an economy in some form it is useless. If it does effect a great economy and it interferes with our taste or our idea of individuality, we must sacrifice one or the other. No doubt for many years to come the economy to be realized from standardizing ladies' hats will be sacrificed to the whims of the fair sex. This lag will no doubt be felt longer because the makers of these hats make capital out of individual tastes.

Standardization will come slowly at first, but the more we are educated into it the easier we adopt it. At first it appears costly because many think it means throwing away the old material, but this is not the way it operates. It is done by gradually working toward the standard, especially in new work. Standards are rarely new productions, but the best of the old ones. Their adoption is very often only the convincing of the customer that he does not need something different and more costly than other people in the same line.

The American Engineering Standards Committee is the national standardizing body for American industry. Its present members are the national engineering societies, the federal departments of War, Navy, Commerce, Agriculture, Interior, Labor and the Panama Canal and national associations representing most of the industrial interests of the country.

It has at present 126 projects underway, of which 35 are approved standards. 205 national organizations and 25 state organizations are represented on its committees by 1,000 individuals.

It maintains intimate relations with the Bureau of Standards, the Federal Specifications Board and the Division of Simplified Practice in connection with the standardization work that these national bodies are carrying on.

From address by Col. E. C. Peck, before the Cleveland Engineering Society.

Jigs and Fixtures for Small Crankcases

By Arthur J. Aires

Locating crankcase from four bolt holes—Centering case from center and end bearings — Special sleeves for supporting crankcase walls while broaching and burnishing

THE jigs and fixtures shown herewith were designed for the production of crankcases for a popular British light car.

The crankcases and their three crankshaft bearing caps are all machined from aluminum castings. These parts are first inspected for faults, and also to see that there is enough metal for machining, before being passed into production. The crankcases are then issued to the shop in multiples of seven, which is the number that can be accommodated at one time on the planer-type milling machine.

The usual batch is forty-two, and the total time required for one crankcase to pass through the shop is 6 hr. The crankcases are inspected after each operation by a system of traveling inspectors, except for the larger operations, which are checked in the inspection room. Details of the crankcase are shown in Fig. 1, while those of the three bearing caps are given in Fig. 2. The overall length of the crankcase is 20½ inches.

The bearing caps are shown dotted, in position, in Fig. 1. They are milled and drilled ready for assembling into the case before the boring operation, so that they can be bored in position.

The first operation consists of drilling the holes for the four holding-down bolts, which are 0.516 in. diameter. The greatest difficulty in designing the jig was in

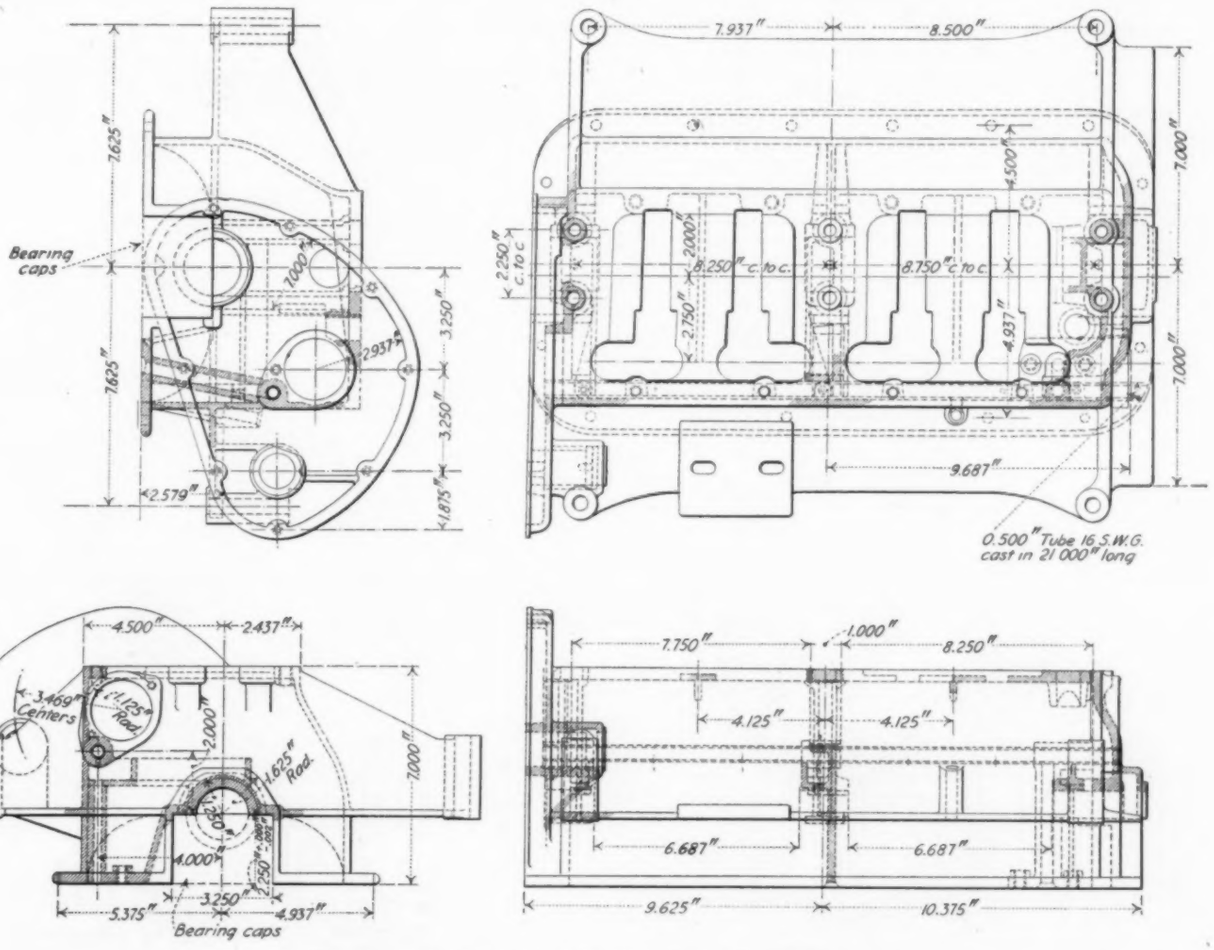


Fig. 1—Details of small British motor crankcase

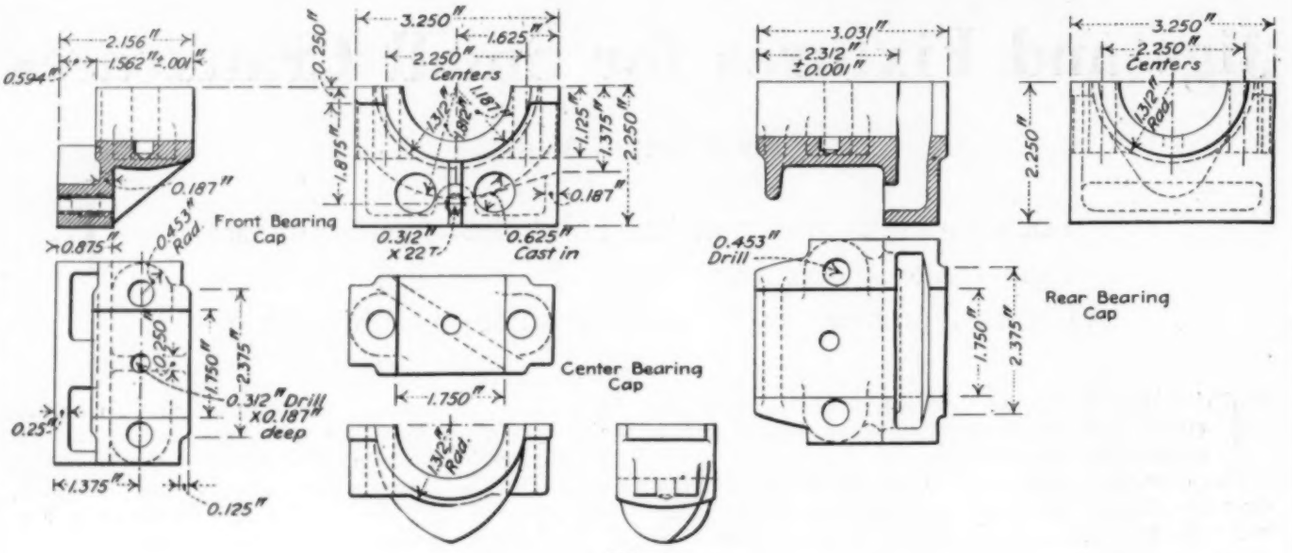


Fig. 2

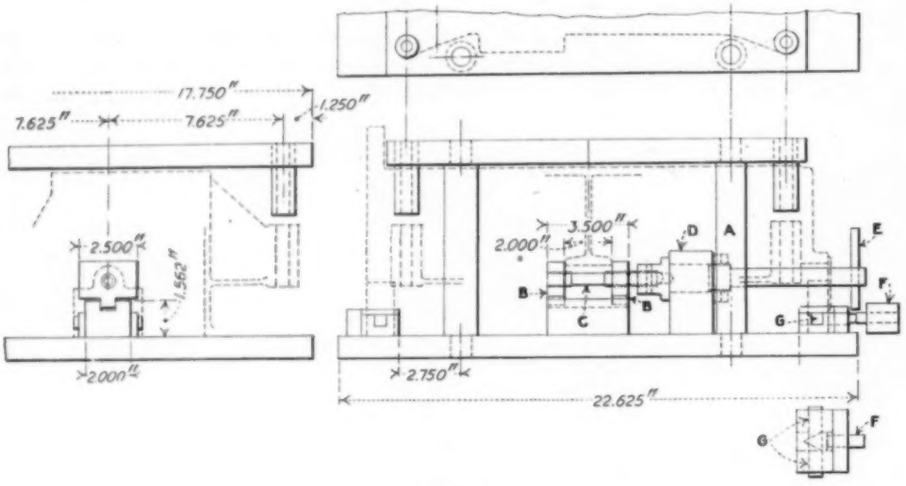


Fig. 3

Fig. 2—The bearing caps used. Fig. 3—Fixture for drilling bolt holes from center bearing. Fig. 4—Fixture for milling joint face and bosses

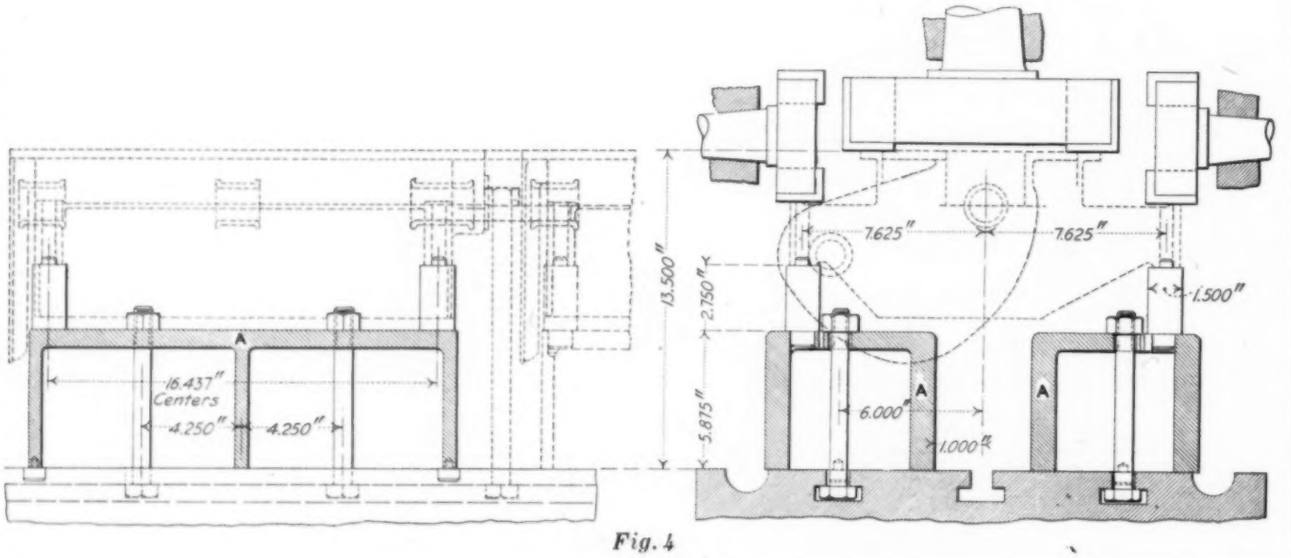


Fig. 4

positioning the crankcase so that the metal would be equally distributed around the various bosses. To accomplish this the jig shown in Fig. 3 was made so that the case would be automatically located both centrally and lengthwise.

The top drilling plate which carries the bushings, is defachable for the easy removal of the work, and is positioned from the base plate by four supports as at *A*. The central bearing in the case is used for lengthwise location, by means of two plates *B*, sliding in a slot. One of these plates is tapped right hand, while the other is tapped left hand and both are carried on a bar *C* with right and left hand threads to correspond. This bar is carried through a bearing block, *D*, and projects far enough outside the fixture to be convenient for operation by means of the tommy-bar or pin wrench, *E*.

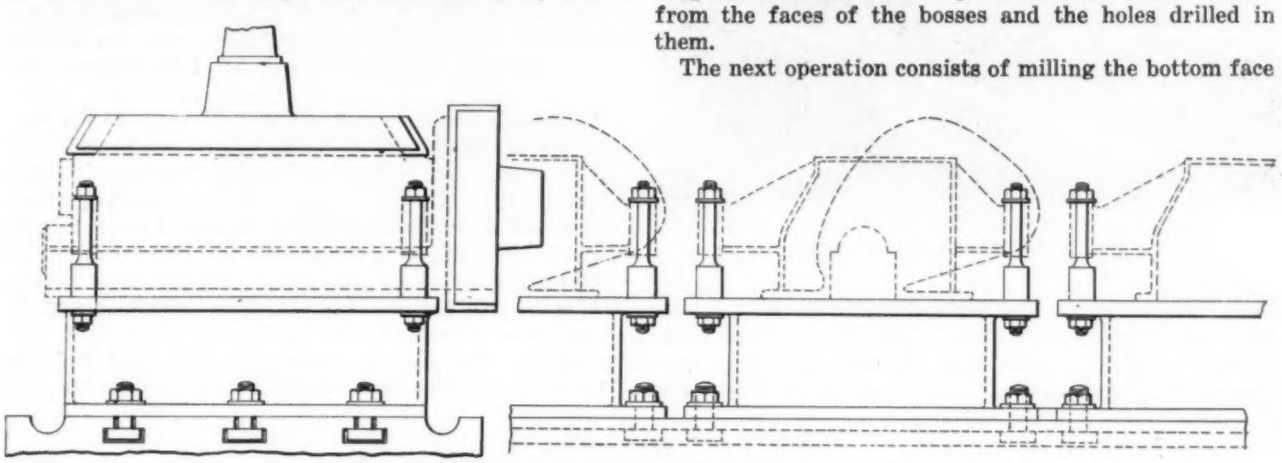


Fig. 5—Fixture for milling top and timing cover face

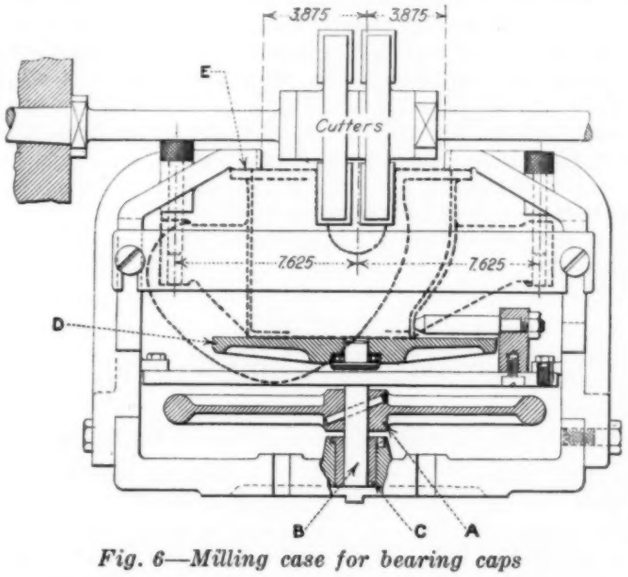


Fig. 6—Milling case for bearing caps

Work Centrally Located by Wedges in Seats for the Bearing Caps

To locate the work centrally, the gaps at each end of the case into which the front and rear bearing caps fit, are brought into use. A wedge is employed which is advanced by means of the knurled screw *F*. The wedge moves the two bars *G*, out equally on each side, thereby effectually centralizing the casting. No other clamps are necessary as it was found that the bars *G* held the crankcase securely during the drilling operation. The drill runs at 700 r.p.m., with a feed of 1¾ in. per minute.

The four bosses are then faced to a pre-determined height and for all future operations the case is located from the faces of the bosses and the holes drilled in them.

The next operation consists of milling the bottom face to which the oil sump is bolted. The four holding-down bolt bosses are machined at the same time. This operation is performed on an Ingersoll milling machine, three spindles being used simultaneously. The vertical spindle carries a 12-in. diameter cutter for milling the bottom face, while the two horizontal spindles face the bosses, using 5½-in. diameter cutters. Fig. 4 shows the necessary fixtures, the machine table which accommodates seven of the cases at each loading, and a diagram of the operation.

Castings as at *A* are used to raise the cases from the bed of the machine so as to clear the timing covers. The cases are clamped to the table by bolts and straps placed between each two cases. Slip or open washers are fitted to the bolts. The clamping bar is drilled large enough to pass over the nuts, so as to facilitate removal of the finished work and also for convenience in resetting. Pins project into the previously machined holes to locate the cases as will be seen by referring to the illustration.

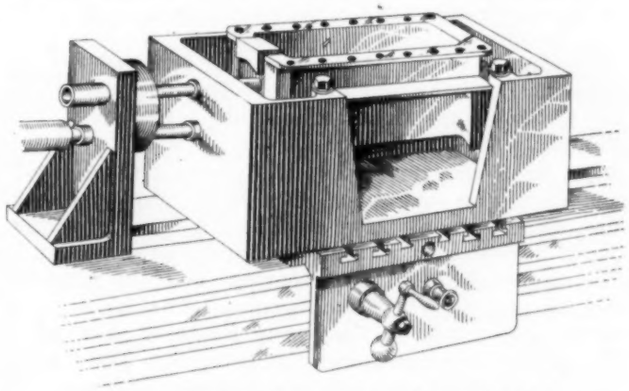


Fig. 7—Boring for crank and camshafts

The upper face, to which the cylinder is bolted, and also the timing cover face, are milled on an Ingersoll machine. The cases are arranged across the bed of the machine, so that the horizontal cutter can mill the

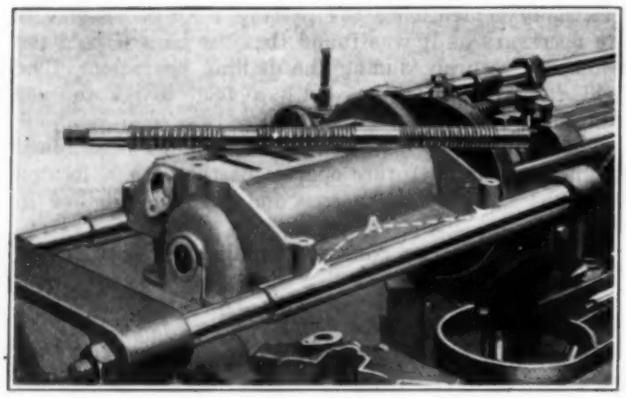


Fig. 8—Broaching the bearings

timing cover faces. The vertical cutter is 18 in. diameter, the others being 10½ in. The floor to floor time for each case is 38 min. The jig used for this operation is illustrated in Fig. 5 and consists of a plate to which the case is bolted by means of the four bolt holes. These holes also locate the case, and insure the face being true and central with the bearings. The floor to floor time is 38 min. for this operation.

The next operation, shown in Fig. 6, consists of milling the gaps in which the bearing caps fit. It is performed on a horizontal milling machine using a pair of 8-in. diameter cutters. The width of the gap milled is 3¼ in. The same locating points namely the four bolt holes, are used for this operation. The handwheel *A* is used to rotate the shaft *B* which, by means of the thread and the fixed bushing *C*, lifts the platform *D* and thereby forces the case against the clamping faces *E*. The time for this operation is 30 minutes.

The holes are next drilled and counterbored for the bolts that hold the bearing caps. The holes are $\frac{7}{16}$ in. and the drill runs at 800 r.p.m. with a feed of 2 in. a minute.

The previously machined caps are now fitted, ready for the boring operation. The three crankshaft and also the three camshaft holes, are all bored simultaneously by means of a fixture, which is shown in Fig. 7. The size of the crankshaft bearing is 1¾ in. diameter and the camshaft is 2 in. diameter. The operation is performed on a lathe, the boring jig being attached to the saddle, which supplies the traverse. The boring bars themselves have no longitudinal movement, the work being fed to the cutters.

The same fixture is used for facing the sides of the bearings by simply changing the cutters. The cutters for facing the rear sides of the bosses are left-handed, so that the rotation of the spindle need not be reversed. The total, floor to floor time is 1¼ hours.

A simple plate jig is used for drilling the magneto-shaft hole and also for drilling the timing-cover hole. The plate is located by plugs in the crank and camshaft holes. For drilling the magneto-shaft hole, a slip bushing is provided so that after drilling, the hole can be reamed to size.

The white-metal bearings are now fitted and the crankcase is ready for the last operation, that of broaching the bearings. The size of these bearings is 1¾ in. in diameter. A Lapointe broaching machine is used, and can be seen in Fig. 8, with the case in position, and the completely assembled broach lying on the top of the case. The bars are milled away at *A* to support the case.

Adjustable distance collars are fitted between the bearings in the case, so that the pull of the broach will not come directly on the thin wall of the case, which might give under the strain. When adjusted, these collars make quite a solid fixture for the broach to pull against. The time for the operation is 15 min.

The construction of the collars and also that of the broach will be seen in Fig. 9. Two collars *A* and *B*, which have a bearing one inside the other at *C* are threaded on the outside, one with a left hand and the other with a right hand thread. By adjusting the nut

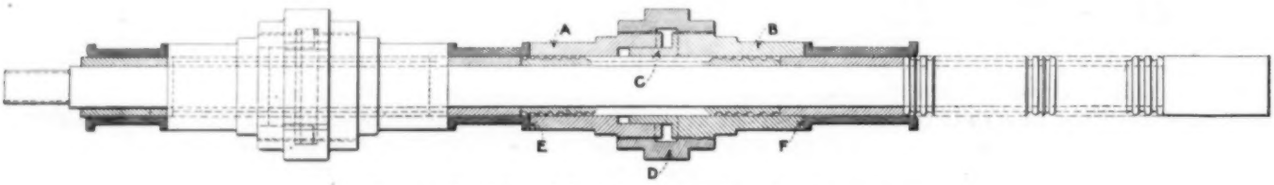


Fig. 9—Details of bearing supports for broaching

D these two collars are forced against the ends of the bearings. A pair of these collars is fixed between each bearing, as at *E* and *F*. The broach consists of alternate cutting and burnishing teeth, except the last three teeth, which are all burnishers. Three sets of broaches are assembled on the one bar, so that the three bearings are all finished at one pass of the broach.

The output of the engine in question has now amounted to four figures, made possible by these fixtures and jigs which have given entire satisfaction, not only in output and interchangeability, but also in first cost and upkeep.

Railroads Using Butt Welding

BY H. A. WOOFER
Electric Engineer, Thompson Electric Welding Co.

The greatest interest in butt welding during the year, has been shown by the large railroad systems of the country, in welders to safe-end locomotive flues and superheater tubes. A few of the railroads have been repairing their flues and tubes in this way for ten or twelve years, but within the last year, the Grand Trunk, Lehigh Valley, Illinois Central, Duluth & Iron Range, Atchison, Topeka & Santa Fe, the Chicago Junction R.R., the Japanese R.R., and the Manila R.R., have all bought electric welders for safe-ending locomotive flues and tubes. To meet this sudden demand, a new welder has been developed for the welding of tubes, flues and pipes exclusively. It is equipped with air-operated clamps, hydraulic, or oil, or hand pressure pushup, as desired, with an electric regulator to suit various sizes of work from 2 to 5 in. in diameter.

From a paper read before Boston Section, American Welding Society, Oct. 1923.

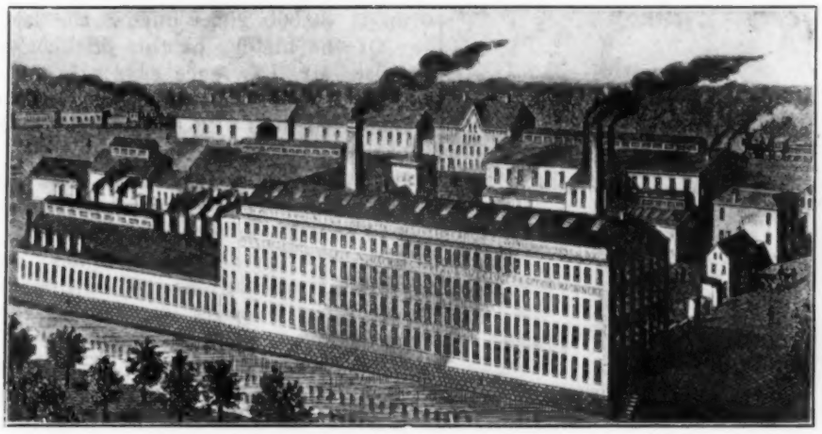


Fig. 63—Pratt & Whitney shops at an early date
(From an old woodcut)

Development of Machine Tools in New England

By Guy Hubbard

The eleventh article—Failure of the Robbins & Lawrence Co.—Hartford plant turns out world-famous products and finally becomes a part of the Pratt & Whitney plant

IN SPITE of the most determined efforts, deliveries of the Minie rifles did not begin until December, 1855—preparations having required nine months instead of three—and the amount of the money advanced by Fox, Henderson & Co. was used up twice over during these preparations. Then for the first five months thereafter the deliveries per month fell short of those expected per week—averaging but 640 rifles per month. Then came a drought in Pennsylvania which forced the sawmills, from which the black walnut for stocks was obtained, to shut down for a greater part of the summer of 1856. This delayed the final assembly of several thousand rifles which might otherwise have gone out. Meanwhile the company was seriously crippled by the financial difficulties growing out of the railway car business, but in spite of all they actually pushed the production of the Minie rifles up to 2,000 per month before the final crash came.

What capped the climax was the quite unexpected ending of the Crimean War in the latter part of the year 1856, upon which for its own protection Fox, Henderson & Co. was really forced to rescind the tardy contract with Robbins & Lawrence. That it acted in good faith is indicated by President Warren Currier who in his "Report to the Creditors" of Sept. 20, 1856, said: "The course of these gentlemen (Fox, Henderson & Co.), also that of their agent now in this country (Col. H. S. Rowan), has been entirely friendly, and such as to evince a desire on their part that the contract should be carried out advantageously."

The Robbins & Lawrence Co. was at the time of the cancellation of the contract, indebted to the Englishmen for the sum of $73,000 for money advanced, and 14,600 Minie rifles out of the 25,000 remained undelivered, thus rendering it liable for $73,000 more under the "Penalty" agreement. The Windsor company was unable to raise these combined sums, and the result was that on June 1, 1857, through a decree of foreclosure, the famous Windsor Armory passed into the hands of Col. Henry Sebastian Rowan of Her Britannic Majesty's Artillery, to whom Fox, Henderson & Co. had assigned its mortgages.

At the time of the debacle at Windsor, the Sharps Rifle Manufacturing Co. took over the Hartford plant of the Robbins & Lawrence Co. and R. S. Lawrence remained with them as master armorer at a salary of $4,000 a year, continuing at the Sharps factory, the machine-tool business which he had previously been carrying on at Windsor. Of this latter Mr. Lawrence says: "We had run a regular machine shop at Windsor, and we continued this work at Hartford, making most of the machines used in our factory, many for the English and Spanish Governments, and for other gun and sewing-machine builders. I tried to have the Sharps Co. enter into this business more extensively as there were bright prospects for the future, but they declined, and this is what brought Pratt & Whitney into the business. If they had taken my urgent advice they (the Sharps Co.) might today be in the position and place of the Pratt & Whitney Company."

In Fig. 63 is to be seen the plant of the Pratt & Whitney Co. at an early date. Mention of Pratt & Whitney in this connection, recalls to mind the considerable influence which was exerted by the designs of the Robbins & Lawrence Co. upon those of another of the famous old Hartford machine industries—that of George S. Lincoln & Co. where, about 1855, Francis

For the author's forthcoming book. All rights reserved.

Fig. 64—The Sharps plant at Bridgeport

A. Pratt was superintendent and Amos Whitney a contractor. This concern was founded in 1834 by Levi Lincoln as the Phœnix Iron Works, and was engaged in building architectural iron work, bank vaults, and machine tools (also highly architectural). When Robbins & Lawrence equipped its Sharps plant at Hartford, it installed therein many of the novel machine tools that had been designed by Mr. Lawrence and his assistant, Frederick W. Howe, at Windsor. Among these were its plain, and universal milling machines, and multiple-spindle drills. These three designs in particular were closely copied by George S. Lincoln & Co. and were made a part of its standard line. The Windsor plain or manufacturing milling machine was somewhat improved in 1855 by F. A. Pratt, and ever since then has been known the world over as the "Lincoln Milling Machine." These three Windsor designs were later adopted by the Pratt & Whitney Co. in almost their original form.

After having been variously known by the above two names, and as Charles L. Lincoln, and The Lincoln Co., this pioneer Hartford industry is today in a thriving condition as the Taylor & Fenn Co. under the leadership of Charles Lincoln Taylor—a direct descendant of the original Levi Lincoln.

The Sharps breech loading rifle, mainly on account of the improvements introduced by Mr. Lawrence—among which were the lubricated bullet, the gas check and the pellet primer lock—became a very popular arm, and the Hartford plant was expanded greatly. When the civil war broke out the Sharps rifles, through the persistent efforts of Col. Hiram Berdan, were ordered by thousands to arm the Union sharpshooters. About 100,000 Sharps rifles were used during the war by the Union armies, and their splendid performance in the field rendered the muzzle loader definitely obsolete in warfare. On account of this heavy demand, a four-story addition 215 ft. long by 45 ft. wide was added to the Sharps plant, and five hundred men were employed night and day—the production being pushed up to 30,000 rifles during the last year of the war.

Of the history of this offshoot of Robbins & Lawrence, Mr. Lawrence says:

"The Sharps Co. commenced on a capital of $100,000, increased it to $125,000 and the stockholders were paid back their full subscription of stock and about $200,000 in dividends, so it will be seen that the stockholders made a good thing out of the enterprise. Mr. Sharps was paid $1 on each rifle made; Mr. Penfield was paid $1.25 (10 per cent on all sales) and with my salary, patents, speculations on machinery during wartime, etc., I found myself worth over $100,000. All this was accomplished by the use and skill of my brain, as I had the full charge and control of the business. One of my great misfortunes in business all my life, was being engaged with men who were not mechanics, and therefore not able to comprehend the points coming up every day. The Sharps Co. had the chance of taking several contracts which I worked up for them where the profits would have been over half a million, but they could not see it and declined—seeing their mistake too late. This company could never agree upon anything and finally sold out the whole plant for $225,000."

Removed to Bridgeport

In the year 1875, Phineas Taylor Barnum, the famous showman, and some other capitalists of Bridgeport, purchased the Sharps Rifle Manufacturing Co. and removed the business to their city. Here it was continued until October, 1881, in a large factory on the main line of the New York, New Haven & Hartford Railroad, in the outskirts of Bridgeport in the direction of New York. See Fig. 64. Since 1881 this Bridgeport Sharps factory has been successively occupied by the Union Typewriter Co., the Yost Typewriter Co., the Remington Typewriter Co., and the Columbia Graphaphone Company.

After 1875, the original Sharps plant in Hartford was occupied by the Weed Sewing Machine Co., see Fig. 65, the sewing machines having been previously built there for ten years on contract. In 1876, the Hartford Machine Screw Co. was also started in this plant, this company being, through Mr. Fairfield, an offshoot of the Weed Sewing Machine Co. and through

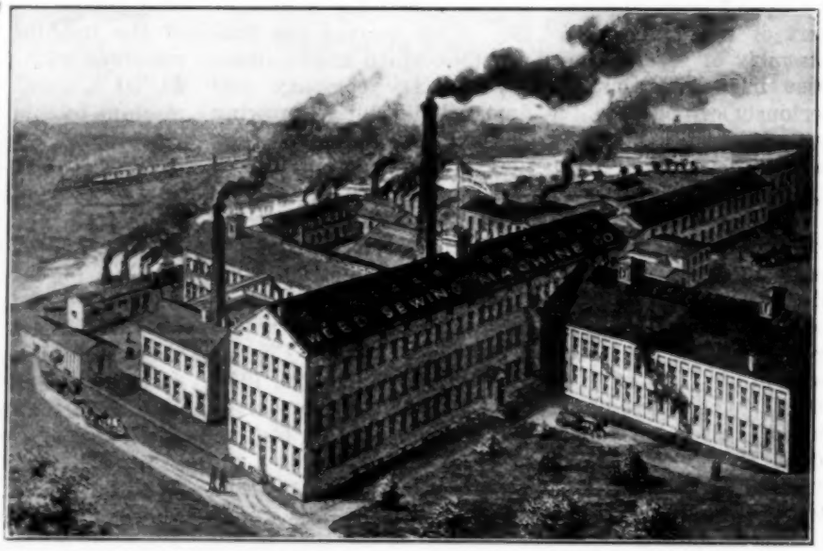


Fig. 65—The Sharps Hartford plant as the Weed Sewing Machine Co. in the early days of the Columbia bicycle

(From an old engraving)

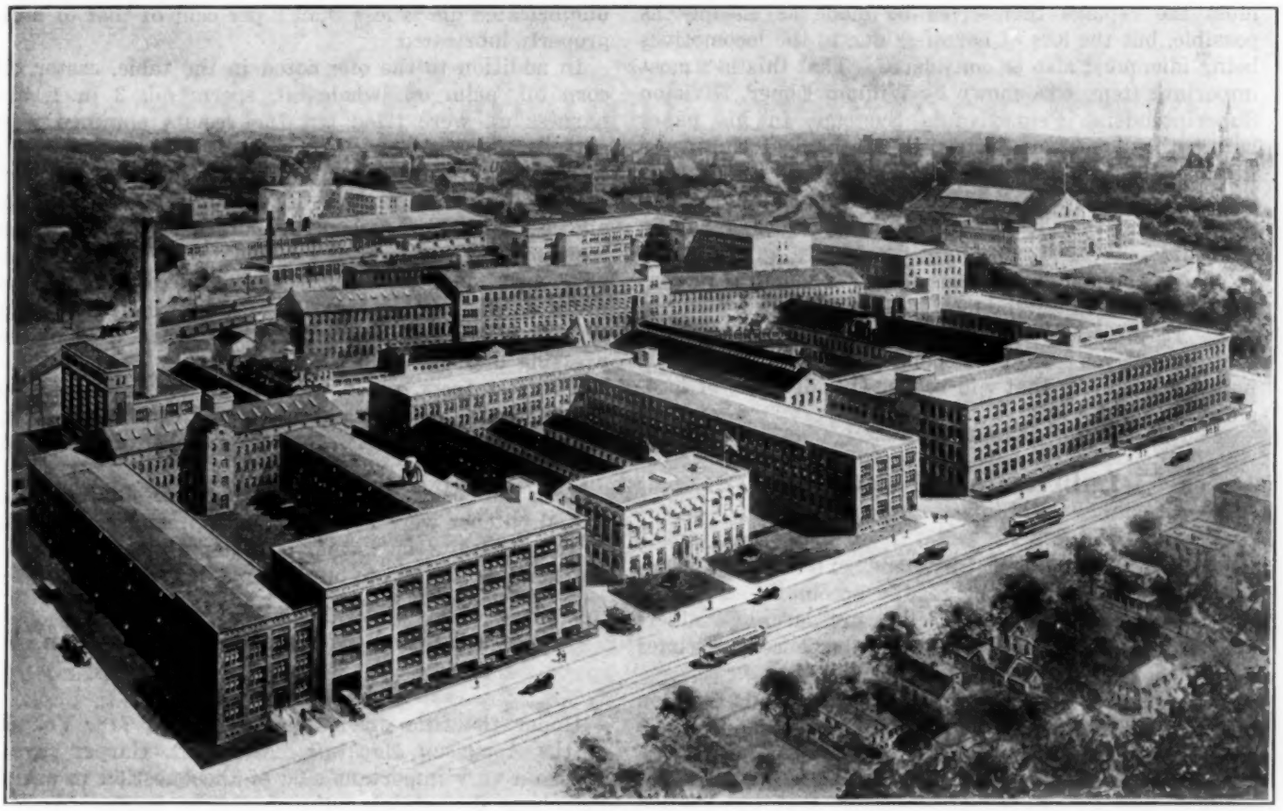


Fig. 66—Present plant of the Pratt & Whitney Co. Buildings in left-hand square were plant of the Pope Mfg. Co. and contain original Sharps plant at rear center

Courtesy of the Pratt & Whitney Co.

Mr. Spencer an offshoot of the Billings & Spencer Co., thus making it also a sort of offshoot of the Robbins & Lawrence Co. In 1880, Col. Albert A. Pope, the pioneer American bicycle manufacturer, contracted with the Weed Sewing Machine Co. to build the early Pope high-wheeled bicycles, and after the Weed Co. closed out a few years later, the Pope Manufacturing Co. occupied the plant. Here, between 1880 and 1914, were built the famous Pope bicycles, the Pope motorcycles and the Pope-Hartford automobiles. In 1914, the old Sharps plant was purchased by the Pratt & Whitney Co., see Fig. 66, and today the original buildings are buildings Nos. 32 and 36 of these internationally famed works.

Thus has this pioneer machinery plant of Hartford run the gamut of interchangeable manufacture—guns, sewing machines, bicycles, motorcycles and automobiles. And finally, appropriate to the romance of industry in which it has such an important role, it has at last been incorporated into the great works of a concern it helped to bring into being more than seventy years ago—the Pratt & Whitney Co.—which succeeded the old Robbins & Lawrence Co. as the leading exponent of the interchangeable system of manufacure.

Keeping Locomotives on the Job

BY CHARLES F. HENRY

The cost of making thorough repairs to locomotives when they come into the back shop is a serious question on all railroads. The increased cost of materials and labor have made the upkeep of locomotives and all rolling stock an increasingly difficult problem. But it is even more necessary to consider the cost of *not making thorough repairs.*

Unless a locomotive is made useless by the fact that the demands of traffic have increased to such an extent that it can no longer handle trains on any branch of the service, it pays to keep it in first class condition. If proper repairs are made, a locomotive is good for from twenty to forty years of service, in the opinion of Lawford H. Fry, Road Foreman of Engines, Union Pacific System. Statistics collected by him show that many of the best railroads in the country keep locomotives in service for about thirty years as an average.

An interesting case is quoted by Mr. Fry. A comparatively small road secured its motive power by buying locomotives condemned by one of its larger neighbors, at a cost of $3,000 each. At this price it was deemed cheaper to run the locomotives as long as possible and scrap them, rather than to put them into the shop for repairs.

In a few years, however, this small road learned that it could not count on this source of supply much longer, and so was confronted with the problem of repairing instead of replacing by other discarded locomotives. After careful consideration it decided that it was more economical to thoroughly repair the locomotives, even at a cost of $10,000 (over three times the original cost to the road) than to discard them as they had done previously.

With this evidence of the advisability of thorough repairs covering a long period of years, the problem of proper machine equipment and methods for making these repairs becomes of vital importance. Not only

must the repairs themselves be made as cheaply as possible, but the loss of earnings due to the locomotives being idle, must also be considered. That this is a most important item, was shown by William Elmer, Division Superintendent, Pennsylvania Systems, in his paper before the American Society of Mechanical Engineers in June, 1921, by data showing that in 1920 the average freight locomotive earned 26 cents per min. or $370 per day and that it ran less than 60 miles a day in doing it.

There are enough problems in the economical repairs to locomotives to try the mettle of any good shop executive. If provided with adequate machine equipment, shop executives can be depended upon to work out improved methods that will reduce the idle time of locomotives.

Lubrication of Hot Dies

BY WM. H. POTTER

Hot pressing, die casting, and extruding of nonferrous alloys can now be readily accomplished by the use of suitable tools and sufficient pressure. Considerable trouble has, however, been experienced at times due to the lack of a suitable lubricant.

During an extensive test of lubricating oils used on hot dies, it was found that the lubricant should meet the following specifications:

1. It is essential that the film of lubricating oil is not easily broken at high temperatures, or that the solution separates.
2. The lubricant should not leave a deposit of solid matter on the surfaces or working parts of the dies.
3. For the automatic spraying of the dies it is necessary to have a lubricant which is liquid at ordinary temperatures.
4. In order to facilitate working conditions the lubricant should be as near odorless as possible.

As shown in the accompanying table, several different

TABLE OF MIXTURES TESTED—FIGURES SHOW PROPORTIONS OF LUBRICANTS LISTED AT TOP

Test No.	Mutton Tallow	Sulphur	Light Mineral Oil	Mutton Oil	Cotton Seed Oil	Cocoanut Oil	Med. Mineral Oil	Beef Tallow Oil	Lard Oil	No. of Parts per Lubrication of Die
1	100	....	....	.....	....	.....	....	.....	.....	20–25
2	.....	....	....	100	....	.....	....	.....	.....	20–25
3	.....	....	....	.....	....	100	....	.....	.....	15–17
4	.....	....	....	.....	....	.....	....	100	.....	15–20 not dependable
5	.....	....	....	.....	....	.....	....	.....	100	7–10
6	50	4	46	.....	....	.....	....	.....	.....	10
7	.....	....	1	1	1	.....	....	.....	.....	5
8	.....	....	1	.....	1	1	....	.....	.....	5
9	.....	....	....	.....	2	1	....	.....	.....	5
10	.....	....	1	2	....	.....	....	.....	.....	30–40
11	.....	....	....	.....	....	1	1	.....	.....	5– 7
12	.....	....	....	1	....	.....	1	.....	.....	8
13	.....	....	....	.....	....	.....	1	1	.....	8–10
14	.....	....	....	.....	....	2	1	.....	.....	15–20
15	.....	....	....	.....	....	.....	1	2	.....	17–20
16	.....	....	....	.....	....	4	1	.....	.....	16–20
17	.....	....	....	4	....	.....	1	.....	.....	110–120
18	.....	....	....	.....	....	.....	1	4	.....	80– 95
19	8	....	....	.....	....	.....	2	.....	.....	105–150

oils and tallows were experimented with. However, it was found that a mixture of 80 per cent mutton tallow and 20 per cent medium mineral lubricating oil gave the best results. It was also found that the life of an unlubricated die is less than 2 per cent of that of a die properly lubricated.

In addition to the oils noted in the table, castor oil, corn oil, palm oil, whale oil, sperm oil, 3 in 1, and harness oil were tried but the results obtained were entirely unsatisfactory.

The mixture of 80 parts mutton tallow and 20 parts medium mineral oil was mixed at 150 deg. F. and allowed to cool. At room temperature it had the viscosity of soft soap and was applied to the die by the aid of a swab. It works equally well on die casting and hot pressing dies. However, when used on die-casting dies its life is but ten per cent of that when used on hot pressing dies.

The test from which these data were obtained ran about 40 days on the same piece, and each result is the average of 1,000 pieces. The total number of tests made was forty.

Both the best refined tallow and tallow obtained from a local butcher were used without appreciable difference in the results. The former is easier to use because the butcher's tallow has to be tried out before using.

Teach Your Boy a Trade—Discussion

BY W. J. FISHER, JR.

Under the title given above, on page 718, Vol. 59, of the *American Machinist*, Robert D. Harper says I ignore a very important side of the question in asking why boys do not learn the machinist trade. While I did not incorporate in my previous articles the same reason given by Mr. Harper, I heartily agree with him that the average schoolteacher is a great deal to blame, and it is not only "the female of the species," but the men teachers and the noted So-and-Sos who address the high school graduates.

I believe the teacher in the primary school should teach the boys that all labor is honorable, and that hands that are soiled in necessary work for the welfare of the world, are the hands that are needed today.

On page 763, Vol. 59, Fred J. Schlegel, Jr., takes the position that it does not pay financially.

It is true as Mr. Schlegel says that machinists' wages seem low in comparison with other trades, but will it always be that way? I think not.

Lawrence F. Swenson in discussing this subject, on page 874, Vol. 59, gives some excellent and logical reasons why boys do not learn the machinist trade, and also states the very sad truth, that much of the old spirit of being able to do a good job is now lacking. But why should a machinist be a "human cam" more than any other man. There is no earthy reason why he cannot advance, simply because he is a machinist. I cannot agree with Mr. Swenson that a college man mingling with professional men is elevated morally and intellectually and that the reverse is true when he associates with machinists.

What can there possibly be in the machinist's trade that will lower a man's morals, and why can he not be as companionable as the average college man?

Yes, teach your boy a trade, and if he is mechanically inclined let it be the machinist trade, and let us hope the *American Machinist* will give its influence to teach this doctrine.

I learned the machinist trade and have never wasted any time wishing I had studied to be a doctor, barber or real dirt farmer.

A Simple Perpetual Inventory System

By C. J. Morrison

A simple and convenient perpetual inventory system for the small shop—Application to various classes of manufacturing — Small amount of clerical work involved

MANY concerns, because they fear the clerical work and expense involved, struggle along without adequate knowledge of the amount of goods and materials on hand, yet this information can be obtained at a trifling expense. The purpose of this article is to show how a small concern may safeguard its business by keeping perpetual inventories, and the method to be given combines purchase order and perpetual inventory records.

The necessary methods will differ slightly with different classes of business and it will be necessary to divide them into three classes as follows:

A—Assembling only
B—Manufacturing and assembling
C—Jobbing.

Furthermore, these methods are intended only for small plants where the quantities of materials or parts are small, and where elaborate systems of requisitions and records would be an unjustified burden. However, in order for the methods to be successful some one person must be designated to make removals from and additions to stock.

Class A is the easiest to handle, but the principle involved is the same in each. The first requirement in all is an orderly storage of materials and parts so that the actual amount on hand can be easily determined at any time. It makes little difference just how the storage is effected, provided it is so arranged that an inventory can be easily taken. Many articles such as screws, nuts, washers, etc., can be best kept in the original packages.

With a class-A business, assembling only, the first thing to do is to make up a complete bill of material. For the purpose of illustration, consider a theoretical shop assembling a radio receiving set of the crystal type for which the bill of material might be as follows:

Article	No. per Set
Box	1
Binding Post	4
Brads	2
Coil	1
Crystal	1
Cup	1
Cup Screw	1

A card such as shown in Fig. 1 should be made out for each item and will serve both as a purchase order and inventory record. The example given shows entries for binding posts and needs little explanation except that the date in the "Delivery" column after the purchase entry order date is the promised delivery date. It will be noticed that the dates in the right-hand column represent weekly entries, and this is one of the features which reduces clerical work.

A companion card is shown in Fig. 2 and is a finished stock record of completed sets, showing the number completed, shipped and on hand each week. The plan is to make entries on the cards only once a week. The production record may be kept on a tally sheet of any description, while the shipment may either be taken from the invoices or may be recorded on the tally sheet and at the end of the week totaled on the card. The parts cards, Fig. 1, should then be posted to show the parts received, used and on hand.

The receipts will be shown by the invoices or, in case no invoice comes with a shipment, a memorandum

ARTICLE Binding Post — USED IN Crystal Receiver
NO. PER MACHINE 4 — MATERIAL Brass-Nickel Plated

PURCHASED FROM	PRICE	DATES ORD.	DATES DEL.	QUANTITY ORD.	QUANTITY DEL.	USED	ON HAND	DATE
John A. Blank & Co.	5 cents per M	5/15 1923	5/30	4000	—	—	0	1923 5/28
			5/23		1500	0	1500	5/26
			5/30		500	0	2000	6/2
						200	1800	6/9
						300	1500	6/16
			6/2		2000	400	3100	6/23
						440	2660	6/30
						340	2320	7/7

Fig. 1—Purchase order and inventory record card

may be made and dropped in the box used to hold the cards. The number of any part used will be the number of completed sets times the number of that part per set, as shown by the bill of material. In addition to the parts used, there may be some defective or spoiled parts and the number of these should also be entered on the cards. The number may be obtained by having a box in the shop into which all such parts are placed and which is emptied each week.

For the class-B business, manufacturing and assembling, let us assume that the product is the same radio set, but that all of the screw machine parts are manufactured instead of purchased. The bill of material will consist of two parts, one the same as before, and the other a list of raw materials and rods of various sizes for the screw machines. The cards for the first part will be handled exactly as for class A and entries will be made for parts manufactured in the shop just as though they had been purchased. The records for the receipt of these parts will, however, be obtained from memoranda placed in the card box whenever parts are received from the screw machines, regardless of whether the parts are placed in stock or sent to the assembling department.

The raw material should be stored in an orderly manner and a card as shown in Fig. 3 used for the record. An estimate of the quantity required for some given unit, such as 100 or 1,000 pieces, should be made and entered on the card. This estimate should be compared

with the quantity used and the number of pieces produced as shown in columns "Used" and "Pieces Produced," respectively. Any discrepancy shown by this comparison should be investigated in order that loss may be prevented or an erroneous estimate corrected. There will probably be cases where several parts will be made from the same raw material and in such cases the different parts may be designated as A, B, C, etc., estimates being made for each and the proper letter placed after each entry under "Pieces Produced." The card provides room enough to enter several estimates.

A pad of paper and a pencil should be tied at some place convenient to the stored material, and whenever

FINISHED STOCK *Crystal Reamer*

DATE	COMPLETED	SHIPPED	ON HAND	DATE	COMPLETED	SHIPPED	ON HAND
6/4	50	0	50				
6/16	75	0	125				
6/21	100	100	125				
6/24	110	100	135				
7/1	85	100	120				

Fig. 2—Finished stock record card

a piece is removed an entry should be made on the pad. Once a week these should be summarized and the proper entries made on the cards.

A class-C business, jobbing, has no regular product, but is continually making different articles on orders from customers and will, therefore, have no standard bill of material. Such a shop will carry a small stock of generally useful raw materials, the records of which can be kept as already described, and also a stock of standard nuts, screws, washers and similar articles, the record of which may be kept on the card illustrated in Fig. 1. As no standard articles are being manufactured, the last column on the Fig. 3, "Pieces Produced," would mean nothing if only the number of parts was recorded, and it may be found useful to enter in this column the number of the order for which the material is used. Also in the case of the parts record, Fig. 1, there would be no entries for "Used In" and "No. per

RAW MATERIAL RECORD QUANTITY *7 lbs* PER *1 pc A 1 pc B*
KIND OF MATERIAL *½" Brass Rod*

PURCHASED FROM	PRICE	DATES ORD.	DATES REC.	QUANTITY ORD.	QUANTITY DEL.	USED	ON HAND	PIECES PRODUCED	DATE
A. B. C. Brass Co.	*14¢*	*6/1*	*5/30*	*15 lbs*	*— lbs*	*— lbs*	*0 lbs*	*———*	*5/14*
			5/30		*15 lbs*	*7 lbs*	*8 lbs*	*100 A*	*6/1*
						14 lbs	*1 lb*	*200 A*	*6/9*
						5 lbs	*3 lbs*	*100 B*	*6/16*

Fig. 3—Raw material record card

Machine," but the other entries would be made as already described.

There will also, in many cases, be special articles purchased for different orders and a record of these is necessary, particularly in cases where the entire orders are not completed before shipment, but partial shipments are made instead. A finished stock record, similar to Fig. 2, should be kept, for each order, but with five columns instead of four, the last column showing the number required to finish the order.

Occasional checks of actual stock on hand against the records should be made and, if necessary, corrections made on the records. It is helpful to make such entries in red ink, placing a number in the "Del." column if the actual quantity is greater than recorded and in the "Used" column if the record is short of the actual supply. The date should also be entered in red to show when the inventory was taken.

Once a month, or whenever a financial statement is to be made, the value of the inventory may be quickly obtained by running through the cards and multiplying the amount on hand, as shown on each card, by the unit price on that card and placing the product either on a pad or recording it on an adding machine if one is available. A slide rule will prove a great time saver for this operation.

In cases where purchases have not been made for some time or where the market is falling, current quotations should be secured and the unit price to be used is either the cost or the quotation, whichever is lower.

Prices for parts manufactured will be the cost of the material plus the cost of manufacturing, while the cost of finished articles will be the cost of the parts plus the cost of assembling, the cost to include burden charges in both cases.

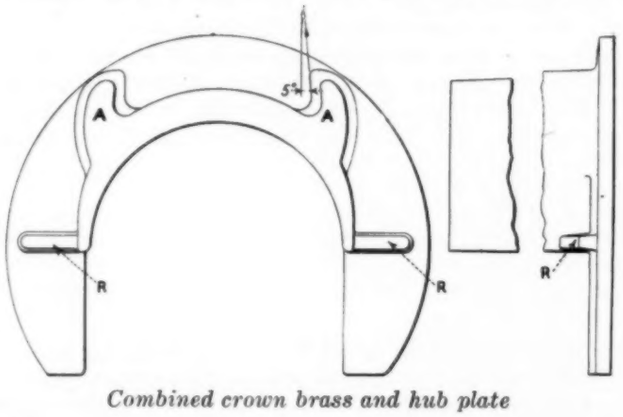
There is no necessity of going to the expense of having cards printed, but standard 5x8-in. ruled cards may be purchased, the vertical lines put on with a lead pencil and the headings either printed or written with pen and ink.

Casting Crown Brasses and Hub Plates in Place—Discussion

By John Mark May

After reading the various discussions under the title given above, in the *American Machinist*, it has occurred to the writer that crown brasses and hub plates might be advantageously cast in one piece, and in place, by using the method of anchoring shown in the accompanying sketch.

The object of this plan is to avoid all machine work on the driving box before pouring the brass. This is accomplished by coring the slots in the driving-box casting for the crown-brass anchors *A-A*, also the depression for the tapered flange and the two ribs *R-R* on the hub plate. The inner edges of the anchors *A-A*



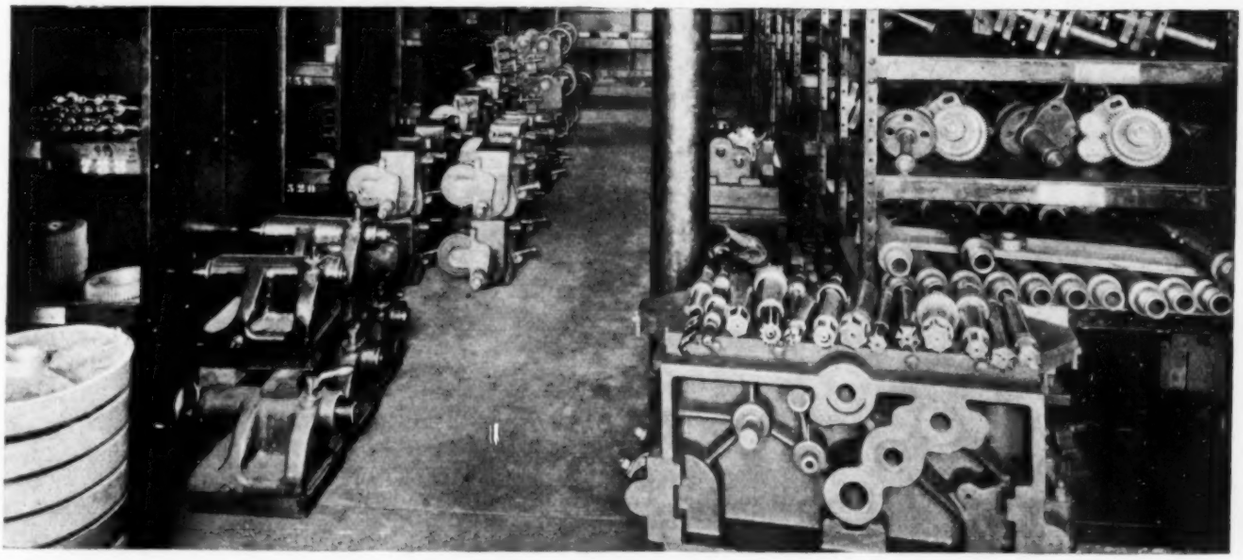
Combined crown brass and hub plate

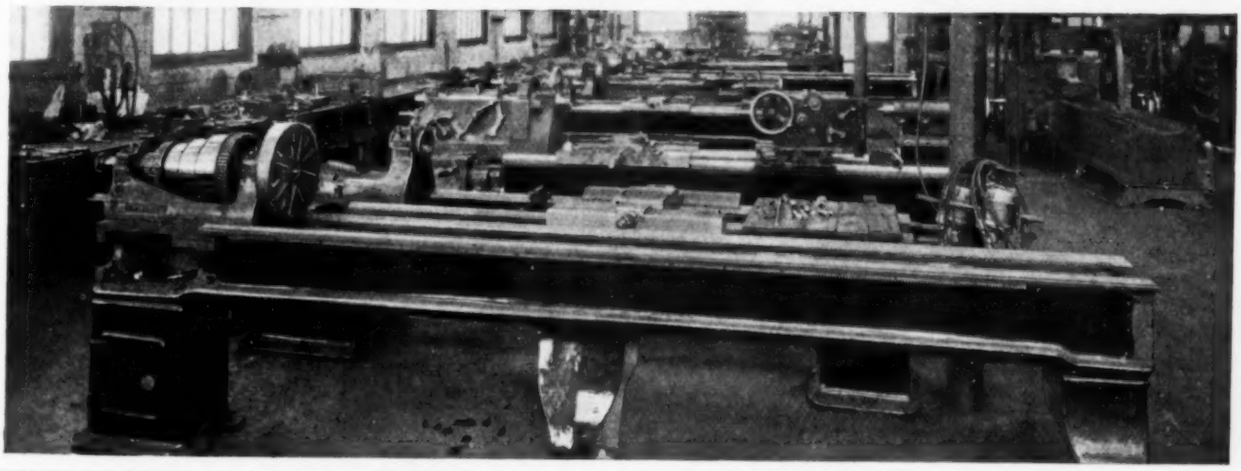
are made to an angle of 5 deg. to prevent their coming loose, and are of liberal proportions to withstand the strain of shrinking during the cooling process following the pouring. All anchorages and ribs are made taper to facilitate the removal of brasses on a press, when they become worn out.

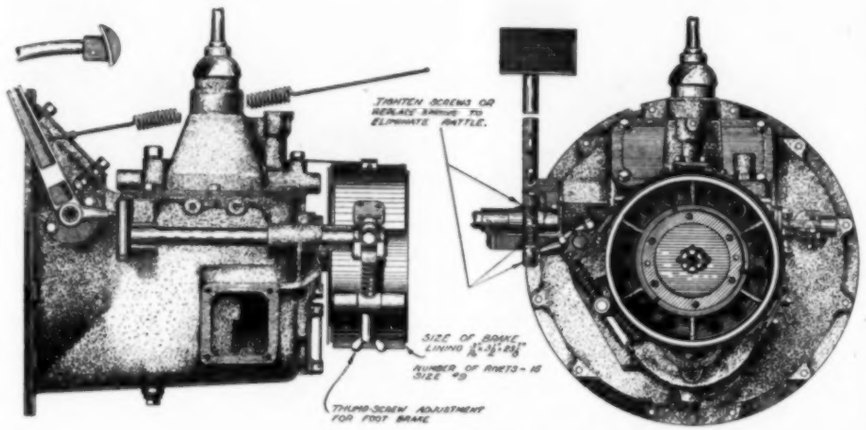
Where Machine Tools Are Made

Cincinnati Lathe & Tool Company

Founded 1906






TIGHTEN SCREWS OR REPLACE SHIMS TO ELIMINATE RATTLE.
SIZE OF BRAKE LINING
NUMBER OF RIVETS - 18 SIZE #9
THUMB-SCREW ADJUSTMENT FOR FOOT BRAKE

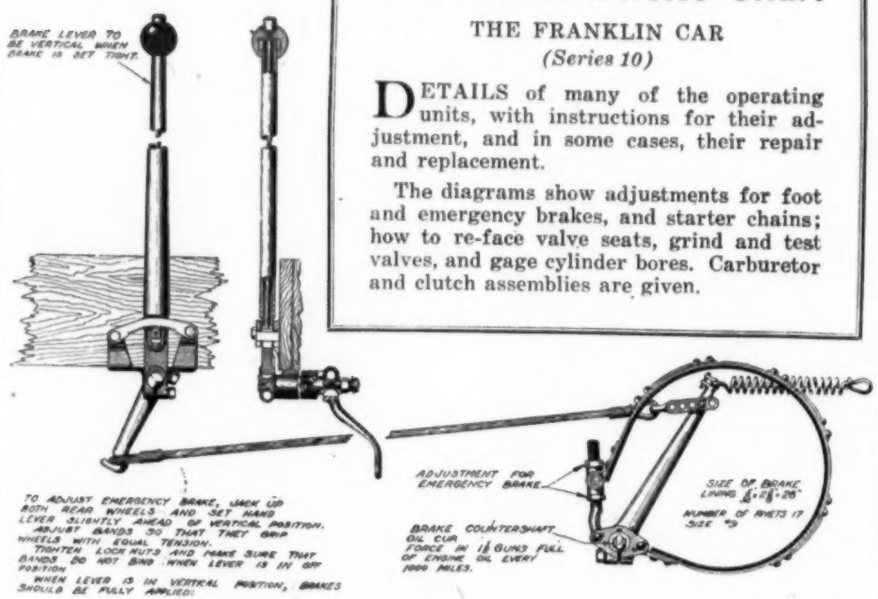
Automobile Service Chart

THE FRANKLIN CAR

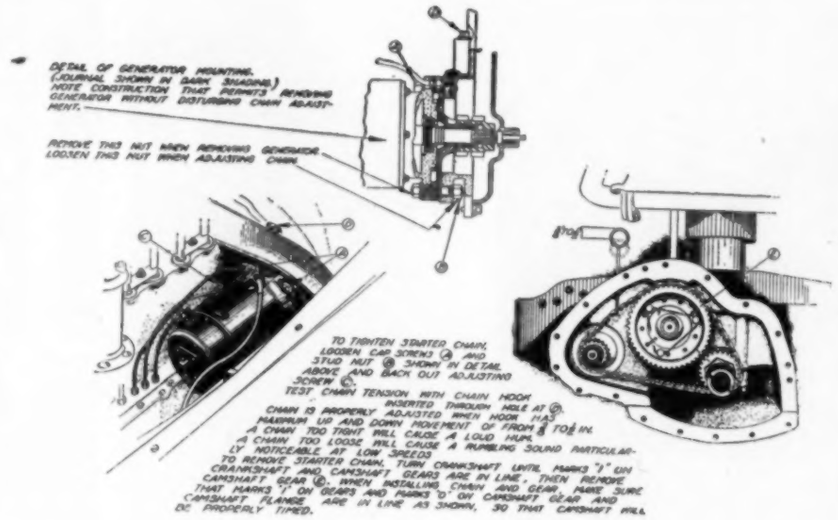
(Series 10)

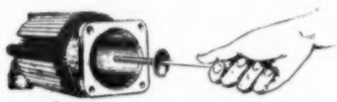
DETAILS of many of the operating units, with instructions for their adjustment, and in some cases, their repair and replacement.

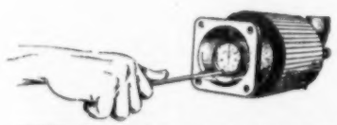
The diagrams show adjustments for foot and emergency brakes, and starter chains; how to re-face valve seats, grind and test valves, and gage cylinder bores. Carburetor and clutch assemblies are given.

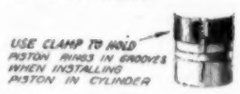

BRAKE LEVER TO BE VERTICAL WHEN BRAKE IS SET TIGHT.
TO ADJUST EMERGENCY BRAKE, JACK UP BOTH REAR WHEELS AND SET HAND LEVER SLIGHTLY AHEAD OF VERTICAL POSITION. ADJUST BANDS SO THAT THEY GRIP WHEELS WITH EQUAL TENSION. TIGHTEN LOCK NUTS AND MAKE SURE THAT BANDS DO NOT BIND WHEN LEVER IS IN OFF POSITION. WHEN LEVER IS IN VERTICAL POSITION, BRAKES SHOULD BE FULLY APPLIED.
ADJUSTMENT FOR EMERGENCY BRAKE
BRAKE COUNTERSHAFT OIL CUP
FORCE IN 1½ GUNS FULL OF ENGINE OIL EVERY 1000 MILES.
SIZE OF BRAKE LINING
NUMBER OF RIVETS 17 SIZE #9

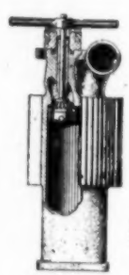
BRAKE DETAILS AND ADJUSTMENTS

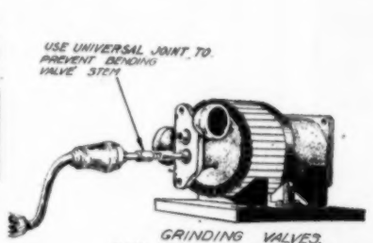

DETAIL OF GENERATOR MOUNTING. (JOURNAL SHOWN IN DARK SHADING.) NOTE CONSTRUCTION THAT PERMITS REMOVING GENERATOR WITHOUT DISTURBING CHAIN ADJUSTMENT.
REMOVE THIS NUT WHEN REMOVING GENERATOR. LOOSEN THIS NUT WHEN ADJUSTING CHAIN.
TO TIGHTEN STARTER CHAIN, LOOSEN CAP SCREWS A AND STUD NUT B SHOWN IN DETAIL ABOVE AND BACK OUT ADJUSTING SCREW C. TEST CHAIN TENSION WITH CHAIN HOOK INSERTED THROUGH HOLE AT D. CHAIN IS PROPERLY ADJUSTED WHEN HOOK HAS MAXIMUM UP AND DOWN MOVEMENT OF FROM ½ TO ¾ IN. A CHAIN TOO TIGHT WILL CAUSE A LOUD HUM; A CHAIN TOO LOOSE WILL CAUSE A RUMBLING SOUND PARTICULARLY NOTICEABLE AT LOW SPEEDS. TO REMOVE STARTER CHAIN, TURN CRANKSHAFT UNTIL MARKS "I" ON CRANKSHAFT AND CAMSHAFT GEARS ARE IN LINE, THEN REMOVE CAMSHAFT GEAR E. WHEN INSTALLING CHAIN AND GEAR, MAKE SURE THAT MARKS "I" ON GEARS AND MARKS "O" ON CAMSHAFT GEAR AND CAMSHAFT FLANGE ARE IN LINE AS SHOWN, SO THAT CAMSHAFT WILL BE PROPERLY TIMED.

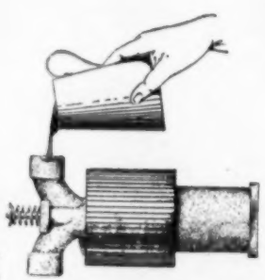




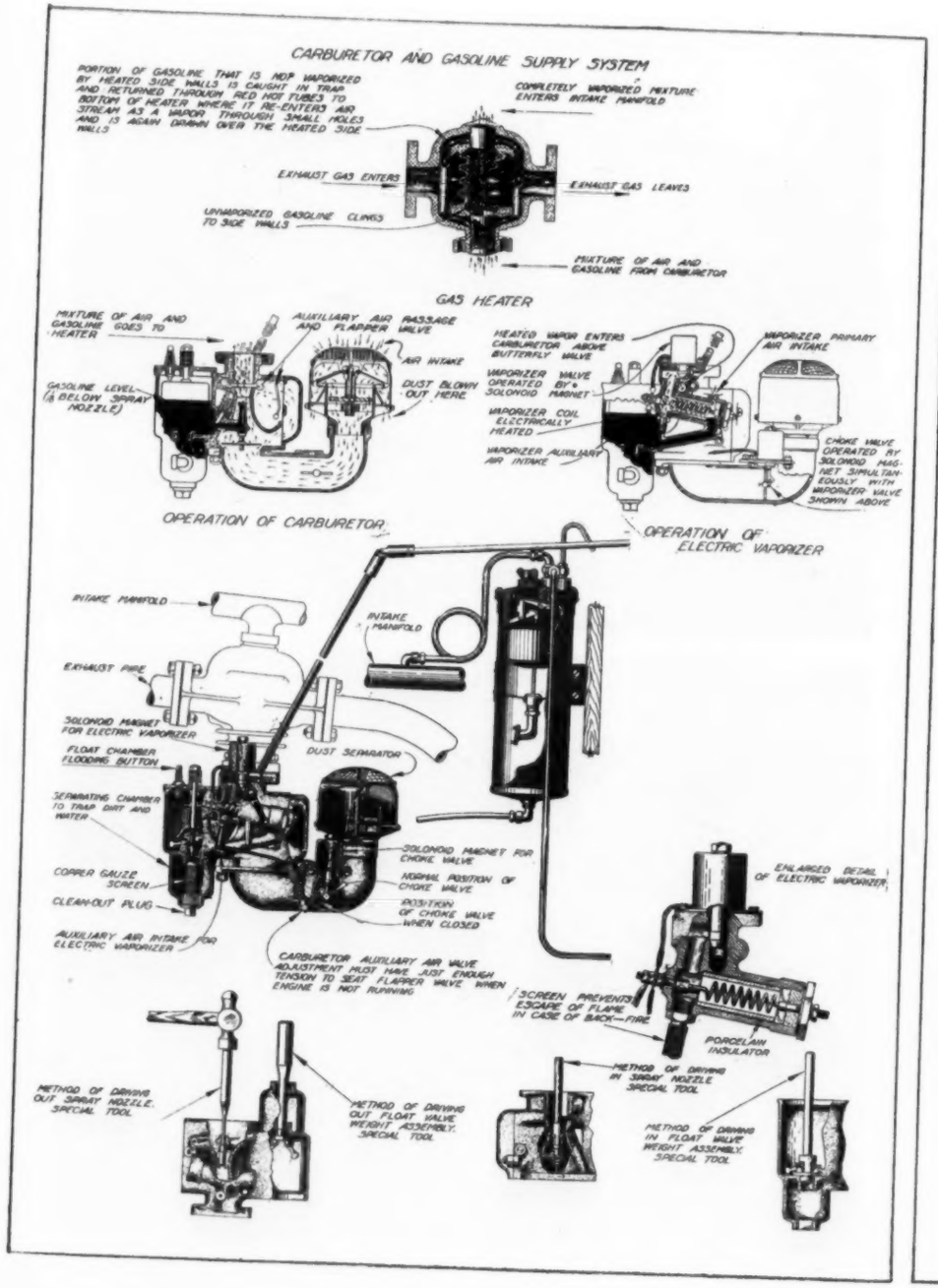


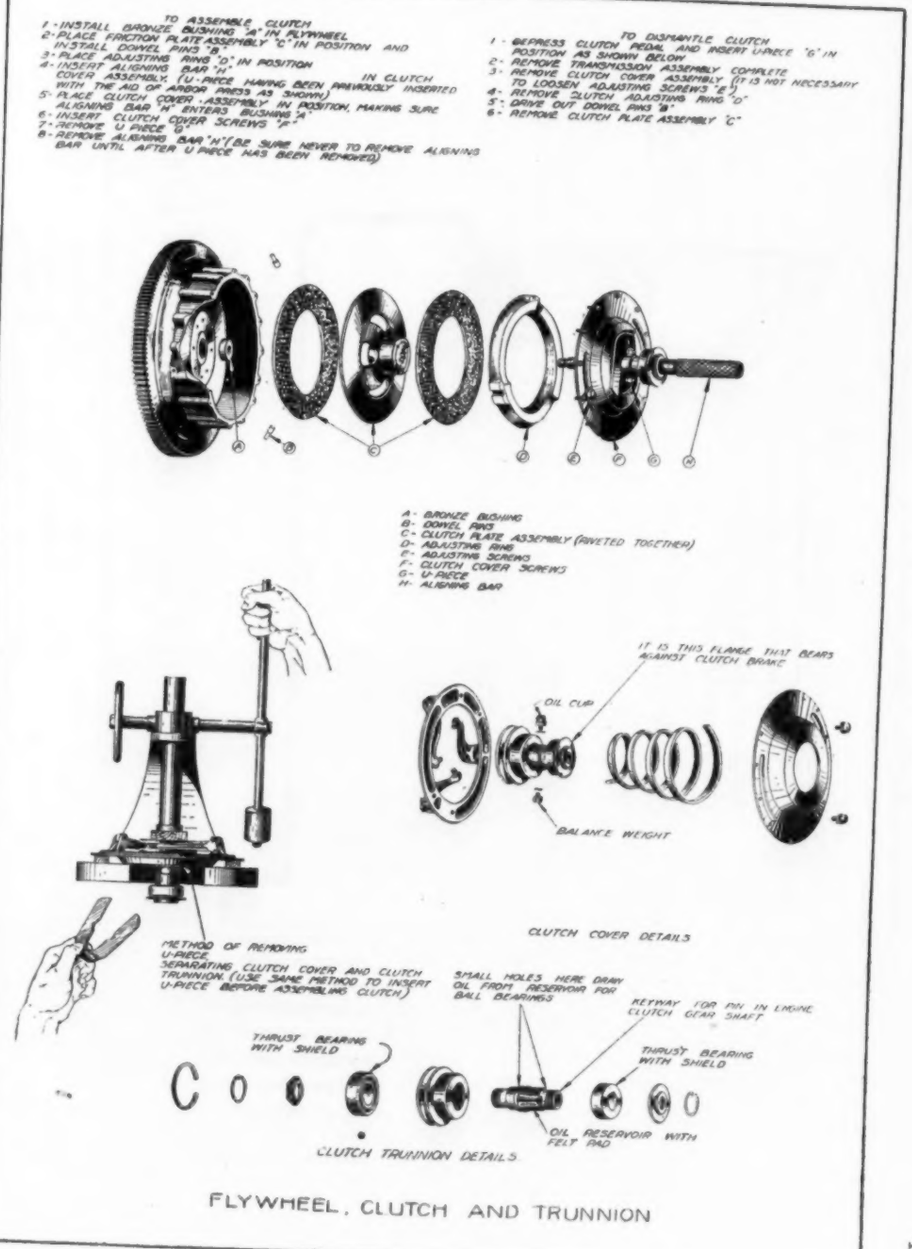



USE UNIVERSAL JOINT TO PREVENT BENDING VALVE STEM
GRINDING VALVES.
SOME MECHANICS SUPPORT CYLINDER BY ITS LOWER FLANGE CLAMPED IN A VISE, BUT WE RECOMMEND A SIMPLE CRADLE AS SHOWN ABOVE. THIS CRADLE SHOULD BE PIVOTED SO AS TO REVOLVE ABOUT ITS CENTER, THUS PERMITTING EITHER END OF CYLINDER TO BE TOWARDS WORKMAN. A PIN THROUGH THE CRADLE BASE INTO THE WORKBENCH WILL HOLD CRADLE IN EITHER POSITION

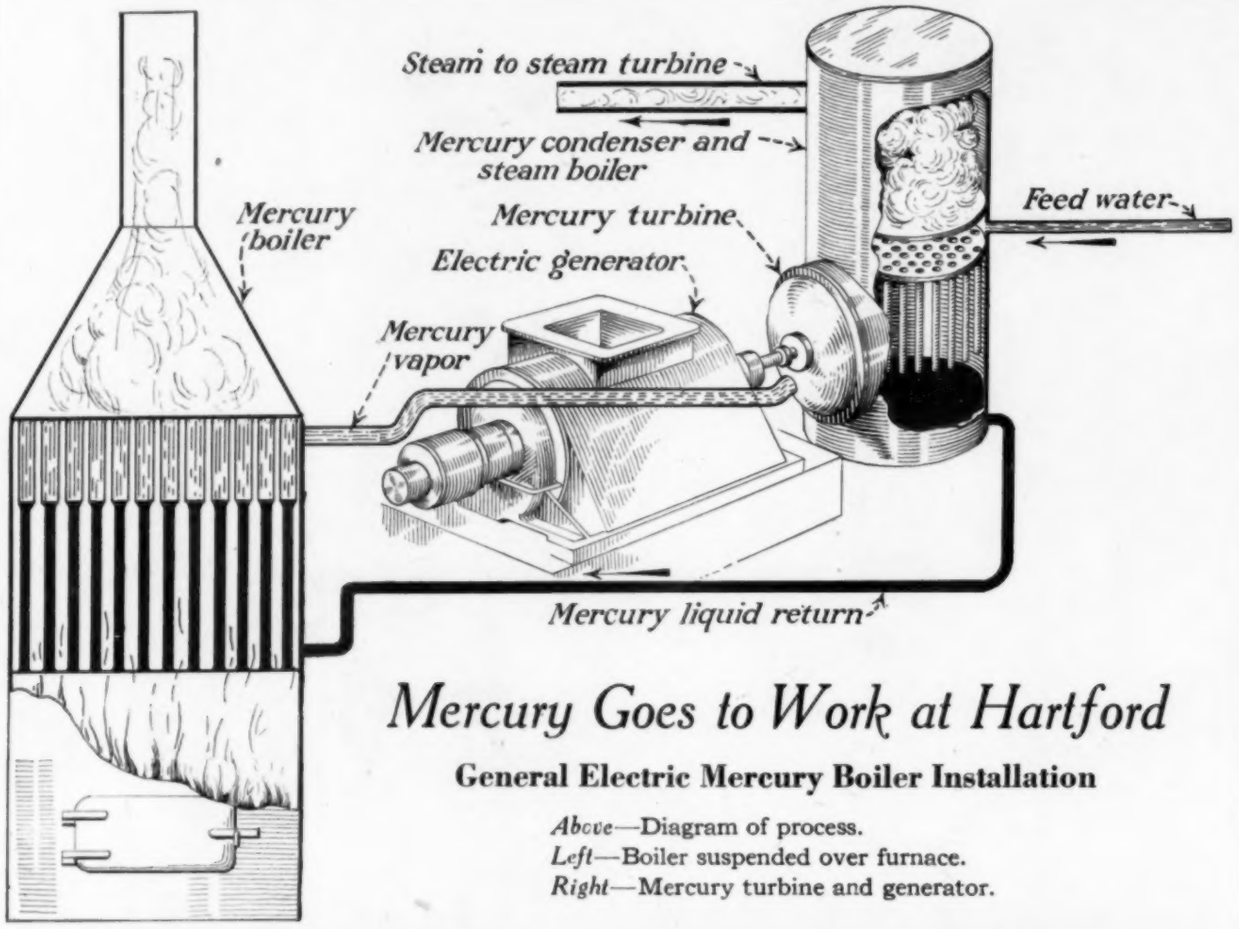


CYLINDER OPERATIONS


CARBURETOR AND GASOLINE SUPPLY SYSTEM
PORTION OF GASOLINE THAT IS NOT VAPORIZED BY HEATED SIDE WALLS IS CAUGHT IN TRAP AND RETURNED THROUGH RED HOT TUBES TO BOTTOM OF HEATER WHERE IT RE-ENTERS AIR STREAM AS A VAPOR THROUGH SMALL HOLES AND IS AGAIN DRAWN OVER THE HEATED SIDE WALLS
COMPLETELY VAPORIZED MIXTURE ENTERS INTAKE MANIFOLD
EXHAUST GAS ENTERS
EXHAUST GAS LEAVES
UNVAPORIZED GASOLINE CLINGS TO SIDE WALLS
MIXTURE OF AIR AND GASOLINE FROM CARBURETOR
GAS HEATER
MIXTURE OF AIR AND GASOLINE GOES TO HEATER
AUXILIARY AIR PASSAGE AND FLAPPER VALVE
AIR INTAKE
GASOLINE LEVEL (A BELOW SPRAY NOZZLE)
DUST BLOWN OUT HERE
HEATED VAPOR ENTERS CARBURETOR ABOVE BUTTERFLY VALVE
VAPORIZER PRIMARY AIR INTAKE
VAPORIZER VALVE OPERATED BY SOLENOID MAGNET
VAPORIZER COIL ELECTRICALLY HEATED
VAPORIZER AUXILIARY AIR INTAKE
CHOKE VALVE OPERATED BY SOLENOID MAGNET SIMULTANEOUSLY WITH VAPORIZER VALVE SHOWN ABOVE
OPERATION OF CARBURETOR
OPERATION OF ELECTRIC VAPORIZER
INTAKE MANIFOLD
EXHAUST PIPE
SOLENOID MAGNET FOR ELECTRIC VAPORIZER
FLOAT CHAMBER FLOODING BUTTON
DUST SEPARATOR
SEPARATING CHAMBER TO TRAP DIRT AND WATER
COPPER GAUZE SCREEN
CLEAN-OUT PLUG
AUXILIARY AIR INTAKE FOR ELECTRIC VAPORIZER
SOLENOID MAGNET FOR CHOKE VALVE
NORMAL POSITION OF CHOKE VALVE
POSITION OF CHOKE VALVE WHEN CLOSED
CARBURETOR AUXILIARY AIR VALVE ADJUSTMENT MUST HAVE JUST ENOUGH TENSION TO SEAT FLAPPER VALVE WHEN ENGINE IS NOT RUNNING
SCREEN PREVENTS ESCAPE OF FLAME IN CASE OF BACK-FIRE
ENLARGED DETAIL OF ELECTRIC VAPORIZER
PORCELAIN INSULATOR
METHOD OF DRIVING OUT SPRAY NOZZLE. SPECIAL TOOL
METHOD OF DRIVING OUT FLOAT VALVE WEIGHT ASSEMBLY. SPECIAL TOOL
METHOD OF DRIVING IN SPRAY NOZZLE SPECIAL TOOL
METHOD OF DRIVING IN FLOAT VALVE WEIGHT ASSEMBLY. SPECIAL TOOL


TO ASSEMBLE CLUTCH
1 - INSTALL BRONZE BUSHING "A" IN FLYWHEEL
2 - PLACE FRICTION PLATE ASSEMBLY "C" IN POSITION AND INSTALL DOWEL PINS "B"
3 - PLACE ADJUSTING RING "D" IN POSITION
4 - INSERT ALIGNING BAR "H" IN CLUTCH COVER ASSEMBLY. (U-PIECE HAVING BEEN PREVIOUSLY INSERTED WITH THE AID OF ARBOR PRESS AS SHOWN)
5 - PLACE CLUTCH COVER ASSEMBLY IN POSITION, MAKING SURE ALIGNING BAR "H" ENTERS BUSHING "A"
6 - INSERT CLUTCH COVER SCREWS "F"
7 - REMOVE U PIECE "G"
8 - REMOVE ALIGNING BAR "H" (BE SURE NEVER TO REMOVE ALIGNING BAR UNTIL AFTER U PIECE HAS BEEN REMOVED)
TO DISMANTLE CLUTCH
1 - DEPRESS CLUTCH PEDAL AND INSERT U-PIECE "G" IN POSITION AS SHOWN BELOW
2 - REMOVE TRANSMISSION ASSEMBLY COMPLETE
3 - REMOVE CLUTCH COVER ASSEMBLY. (IT IS NOT NECESSARY TO LOOSEN ADJUSTING SCREWS "E")
4 - REMOVE CLUTCH ADJUSTING RING "D"
5 - DRIVE OUT DOWEL PINS "B"
6 - REMOVE CLUTCH PLATE ASSEMBLY "C"
A - BRONZE BUSHING
B - DOWEL PINS
C - CLUTCH PLATE ASSEMBLY (RIVETED TOGETHER)
D - ADJUSTING RING
E - ADJUSTING SCREWS
F - CLUTCH COVER SCREWS
G - U-PIECE
H - ALIGNING BAR
IT IS THIS FLANGE THAT BEARS AGAINST CLUTCH BRAKE
OIL CUP
BALANCE WEIGHT
METHOD OF REMOVING U-PIECE SEPARATING CLUTCH COVER AND CLUTCH TRUNNION. (USE SAME METHOD TO INSERT U-PIECE BEFORE ASSEMBLING CLUTCH)
CLUTCH COVER DETAILS
SMALL HOLES HERE DRAW OIL FROM RESERVOIR FOR BALL BEARINGS
KEYWAY FOR PIN IN ENGINE CLUTCH GEAR SHAFT
THRUST BEARING WITH SHIELD
THRUST BEARING WITH SHIELD
OIL RESERVOIR WITH FELT PAD
CLUTCH TRUNNION DETAILS

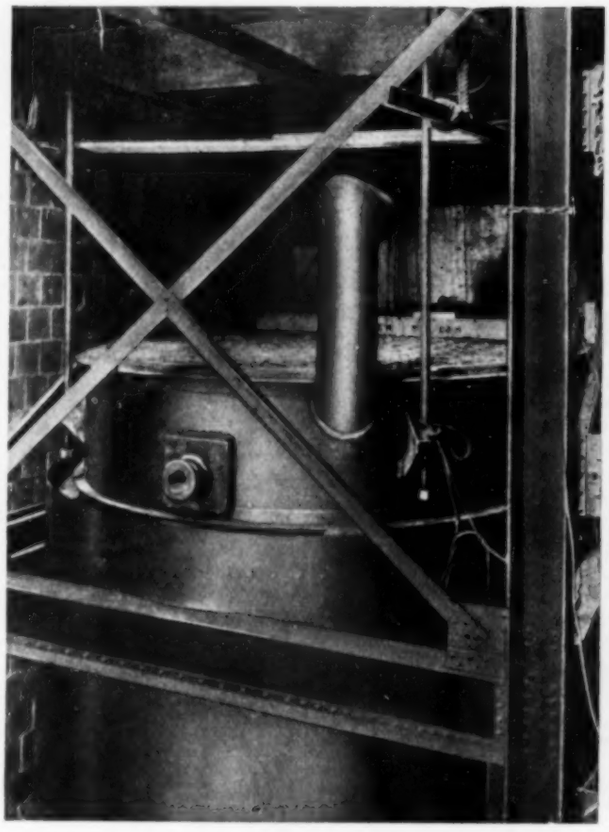
FLYWHEEL, CLUTCH AND TRUNNION

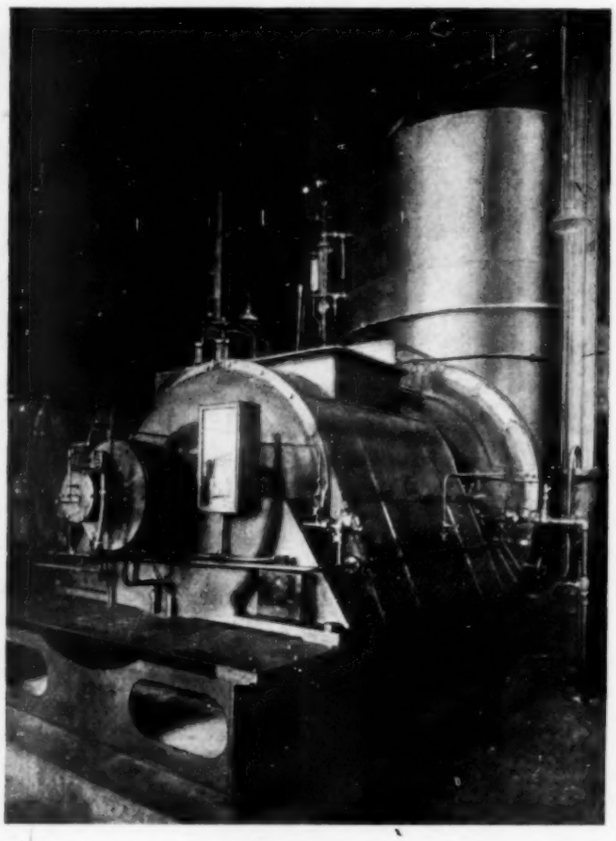


Mercury Goes to Work at Hartford

General Electric Mercury Boiler Installation

Above—Diagram of process.
Left—Boiler suspended over furnace.
Right—Mercury turbine and generator.





Gages Produced in a University Shop

By C. J. STARR

THE regular student product of the shop laboratories at the University of Illinois is a two-cylinder, four-cycle marine gas engine, rated at 8 hp. Regular production of such a complicated article in a university laboratory necessitates high grade tools, accurate but simple since they are to be used by students. Proper gages are necessary if work is to proceed on a production basis, as the instructional program requires, and if assembly of engines is to move forward regularly without the usual delays caused by fitting, which, of course, means the complete loss of any semblance of interchangeability.

An analysis of the various dimensions of the engine requiring close limits soon brought out the point that a product such as this with over seventy-five parts to be manufactured by students would require many accurate gages. To obtain these gages was imperative but, on account of limited finances, it was not possible to purchase commercial gages, and it was decided to make the gages locally.

In considering the design of these gages several factors were considered as important, namely that they were to be used by unskilled labor, the equipment available for their production, and the number of gages required. The simplicity of design will be noticed in Fig. 1, and accuracy, strength and the service required were foremost in mind during their construction.

As soon as the several frame sizes were established and the design completed, proper orders were placed on the pattern and foundry laboratories for the production of the quantity of gage frames required. The patterns were made and the castings produced on a regular production basis. The work of supervising and producing the castings in the foundry laboratory was carried on by students as a regular laboratory exercise and highly satisfactory results were obtained.

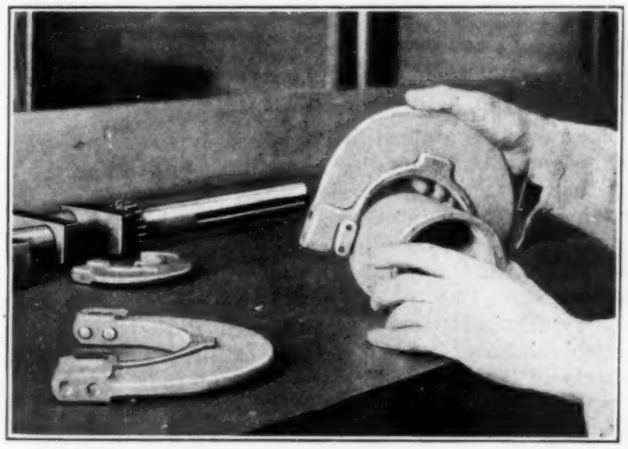


Fig. 1—Use of gages for inspection

The machining of the gage frames, fitting and grinding the hardened gage points when in place and the final adjustment was performed by the laboratory mechanician. To assure alignment of the holes in the frames for the hardened gaging points, a jig of the indexing type was constructed as shown in Fig. 2. The gaging points were made of hardened drill rod fitted snugly into the frame and held in place by an adjusting or backing-up screw and a clamping screw. To insure that these points would remain flat and parallel, a holding fixture was made and fitted to a tool and cutter grinder. Grinding all the points at one setting was then an easy matter.

After grinding, the gages were adjusted to the sizes that had been previously engraved on the frame by checking with a set of commercial block gages. The adjusting screws were then sealed over, the gages were painted and placed in the respective tool trays that had been previously provided for each operation on the engine. A duplicate set of gages was also provided for use in the inspection division. Working gages were painted black and inspection gages gray. In all approximately one hundred and seventy-five were constructed.

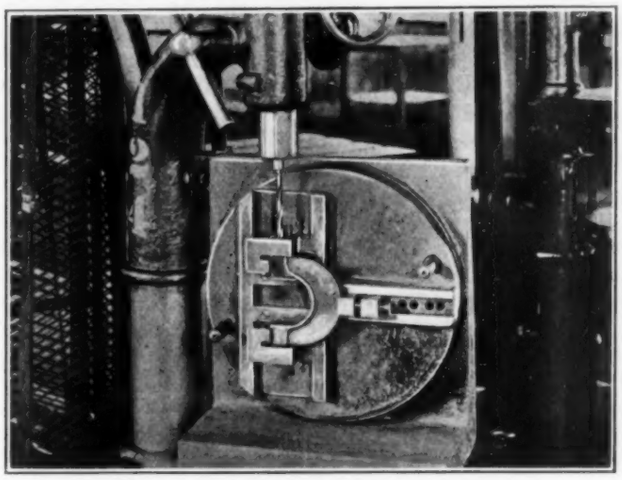


Fig. 2—Drilling gage frames in jig

The increase in quality of workmanship of the students since the completion of these gages is very noticeable and has justified the time spent in their production.

When establishing the limits on the drawings of the several engine parts no consideration was given to the fact that these parts were to be produced by student labor. All dimensions requiring limits were made close with a view to establishing interchangeability, such as would be found in any modern high grade plant. The accuracy required is equal to that of the majority of shops, yet it is interesting to note that the student, after proper instruction in the use of these gages, produced work within the limits specified with comparative ease.

The use of these gages in instructional work is many fold. They not only enable the student to produce a higher quality of work but they also demonstrate to him the importance of such gages in a manufacturing program. They help to bring strongly to the student the need of standardization of a product if duplicate manufacture on a predetermined schedule is to be maintained. By the use of gages the student is able to see more clearly their direct bearing on production, and how quantity production may be assured along with a high quality of workmanship. The matter of

limits and allowable tolerances on dimensions is brought forcibly to his attention.

As the main object of the shop laboratory course at Illinois is the teaching of the principles of management, by laboratory training in the production of a commercial article, the use of gages is a practical demonstration to the student of correct practice in the production of duplicate parts.

The gages have been in use for the past year with highly satisfactory results. Repeated checking of the gages after comparatively rough usage has shown but few instances of inaccuracy or variation from the dimension. They are a typical illustration of what may be accomplished by the usual shop staff in successfully carrying out principles of construction by the use of ordinary equipment.

Book Reviews

The Mailing List Directory. By Dana, Morely and Kight. 727 pages, 6x9 in. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, Price, $10.

Those who want to buy or sell articles of a specific class are often at a loss to know how or where they can reach dealers, manufacturers, buyers or purchasing agents representing the line of goods in which they are interested.

It is a safe bet that the daily mail of nearly all business houses contains many inquiries as to where this or that line of goods or specific article can be bought or sold. In fact, so numerous have such inquiries become, that many large business houses maintain information bureaus for the benefit of their customers.

If the people, making these inquiries, knew and would avail themselves of the Mailing List Directory, they could at once find out how to get the information sought for.

This book is very complete and covers sources of information as to buyers and sellers of merchandise and supplies in all kinds of business.

While the assembling of such a book required the looking over and digesting of a tremendous mass of material, the work has been well and carefully done, and reflects credit upon its compilers.

Definitions of Trade Terms. Known as Digest No. 43. Published by the International Chamber of Commerce, Paris, France. Copies can be secured from the American Section of the International Chamber of Commerce, Washington, D. C. Price 75c.

This book gives the definitions of trade terms approved by national committees and comparative tables of definitions. Why it was written and the objects that it is expected to accomplish may be learned from the following statement made by the American Section:

"Publication of the digest marks the first serious effort on the part of business interests throughout the world to bring some order out of the chaos which prevailed in the interpretation of trade terms in foreign trade.

"The use of the cable in the quotation of prices, as well as the use of the brief business letter, have led to the omission of elaborate details in contractual obligations and to the use, in their stead, of trade terms, in particular the terms "F. O. B.," "F. A. S." and "C. I. F." Each nation has witnessed the growth of its own particular set of definitions and has for the large part left it to the individual trader to discover —often to his sorrow—the points of difference between definitions of his and other commercial nations.

"For instance, American business men had been lectured frequently by their overseas clients upon the exact meaning of "F. O. B." The American interpretation of "F. O. B." corresponded to the British expression "F. O. R." (free on rail), or "F. O. T." (free on truck). The Britisher also used the term "F. O. B.," but had in mind the obligations assumed by the American quotation "F. O. B. vessel," and this seemingly small conflict in meaning between the American and British interpretation was the cause of many bitter disputes in overseas trade.

"Aware of the difficulties that would be encountered in any endeavor to bring about uniformity in the interpretation of trade terms, the Committee of the International Chamber of Commerce which prepared the digest took as their objective the publishing of a clear statement of the recognized interpretation of terms and abbreviations as in use in the large commercial countries.

"The American definitions were carefully surveyed by a committee consisting of C. D. Young, resident attorney of the American Trading Co.; C. D. Snow, manager of the Foreign Commerce Department, Chamber of Commerce of the United States, and E. A. LeRoy, Jr., National Foreign Trade Council."

Proceedings of the Twenty-Sixth Annual Meeting of the American Society for Testing Materials. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. In two parts, 6x9-in. pages. Part I contains committee reports and new and revised tentative standards, 1,006 pages. Part II contains technical papers, 683 pages. The prices for each part: paper $6, cloth $6.50, half leather $8.

The reports contained in Part I are annual reports of thirty-two of the standing committees of the society together with the discussion thereon at the annual meeting, and one hundred and three tentative standards which have been revised or are being published for the first time; and the annual address of the executive committee.

The technical papers published in Part II contain valuable information on results of investigations by experts in the field of engineering materials. The reports of the committees cover ferrous and non-ferrous metals, cement, ceramics, concrete, gypsum, lime, preservative coatings, petroleum products, road materials, coal and coke, waterproofing materials, electrical insulating materials, shipping containers, rubber products, textile materials, methods of testing and nomenclature and definitions.

Firth-Sterling Stainless Steel. Sixty pages, 6x9 in., cloth boards, illustrated. Published by the Firth-Sterling Steel Co., McKeesport, Pa. Price, $1.

This book contains a comprehensive treatment of the corrosion resisting properties, physical characteristics, practical manipulation and field of application of stainless steel and stainless iron.

Ideas from Practical Men

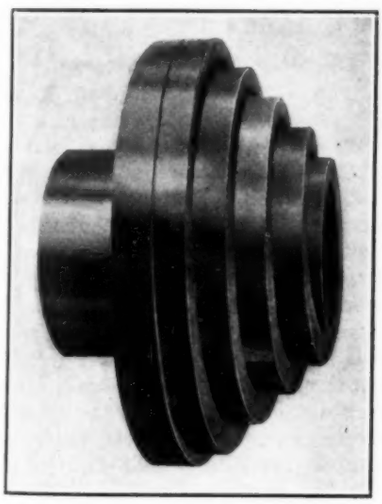
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices tha have proved their value are carefully con sidered, and those published are paid for

Generating a Conical Spiral in a Lathe

BY JACK WILLIAMS

The words "spiral" and "helix" are often confused in the minds of men who have to do with things mechanical, and not a few, even among those who aspire to the title of engineer, handle these terms in a reckless manner. Some of them do not know that a spiral is *not* a helix, and they speak of "spiral springs," "spiral flutes," etc., with confidence, when the things they have in mind are not spirals at all, but helices.

Notwithstanding the fact that most dictionaries sanction the use of the word spiral to define a helix, the words as they are applied in the realm of mechanics actually designate two separate and distinct characteristics. Without going back to the dictionary (where we would find that the word may mean anything from a church steeple to a snail-shell) a spiral may be defined as a line wound or wrapped around a central point in such a manner that its radial distance from the central point about which it is wrapped increases continually as its convolutions are multiplied. It is no more a helix than is any involute curve. A clock spring, for instance, is a spiral spring, and so nearly is it the only representative of its class in mechanics that any truly spiral spring is most often referred to as a clock-spring, even though the mechanism to which it is applied be far removed from those of clocks.



A spiral-helix cut in a lathe

Though a true spiral lies in a single plane, its arbitrary function is its radial increment. If it departs from the plane it may still be a spiral, but it has acquired some other characteristic that demands a qualifying adjective to designate it properly.

A helix is also a line wrapped around a center, but instead of being a point, the center must itself be a line; for the multiplying coils of a helix, while maintaining a uniform diameter, must advance axially along the line that is the center. In short, the arbitrary function of a helix is *lead*. It may depart from its uniformity of diameter without losing its identity as a helix but, like the spiral, it, also, has then become something else besides a helix.

A single object may be both helical and spiral, but only because it combines two separate and entirely unrelated functions. A coil spring wound upon the surface of a cone is a helix because of the axial advance of its coils, and a spiral because of their radial increment, but it is obvious that it cannot be clearly designated by either term alone. Fortunately its conical shape provides an easy solution for the difficulties of nomenclature, and it may be called a conical helix or a conical spiral with equal propriety and without fear of confusion.

The illustration accompanying this letter shows a piece of cast-iron that combines the characteristics of the helix with that of the spiral, and clearly shows the application as well as the difference of the two terms.

The piece is not a fancy product intended to demonstrate my point, it is an actual working part of a real machine, made to a customer's specifications. The reason for its appearance here is that I am going to tell you how disgustingly simple it is to do an apparently impossible job—when you find out how it is done.

The mean face-angle of the piece is 45 deg. (90 deg. included). The radial increment of the spiral is $\frac{1}{4}$ in. per turn and the lead of the helix is the same. When the job was first considered, it seemed to call for a lot of special rigging on the milling machine and promised to consume a deal of time in the making.

In the modern Hendey lathe, the traverse movement of the carriage and the cross movement of the toolslide are calculated on the basis of a 1 to 1 ratio, so that with both feeds locked in, the tool point will travel along a line that is inclined at an angle of 45 deg. to the axis of centers. The feed movement is derived from the leadscrew and is calculated to a 1 to 4 ratio with the latter, so that if the lathe were geared to cut a thread of, say, $\frac{1}{4}$ in. lead with the locknut closed upon the leadscrew, it could be depended upon to cut a thread of $\frac{1}{16}$ in. lead with the locknut open and the feed engaged in its stead. The lathe is, moreover, provided with a sub-headstock that reduces the rotative speed of work held between centers to one-sixth that of the lathe spindle itself.

With this arrangement, then, it is necessary only to set the indicating levers controlling the change gears for a thread of 0.333 in. lead (three threads per inch), lock in the traverse and cross feeds together and, with a square-nosed tool in the toolpost, proceed exactly as if cutting a thread over the inclined surface of the cone.

The sub-headstock was used on this job, only because of the extreme pitch of helix and spiral. It could have been done without the sub-headstock if it were convenient to gear the lathe to a lead of one turn in two inches, but this would require extra gearing. With the same set-up as described and without the sub-headstock, a spiral-helix having a radial increment and lead of $\frac{1}{16}$ in. would have been cut upon the 45-deg. surface.

Crankpin Production

By Ulysses V. Garred

Many railway shop foremen have considerable trouble in meeting the demand for driving-wheel crankpins, usually on account of the slow and costly lathe operations. The illustrations show how this job has been successfully transferred from the lathe to the drill press, so far as the drilling, counterboring and tapping are concerned. The pins are given in detail in Fig. 1.

The fixtures shown in Figs. 2 and 3 handle the drilling, counterboring and tapping without removing the

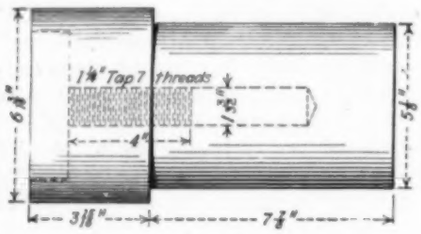


Fig. 1—Details of crankpin

work. The former method of handling the crankpins in the lathe was to first turn the outside to size and then polish. The pin was then placed in a steady rest for drilling, counterboring and tapping. In addition to the time lost in setting the steady rest, the pin would occasionally be cut by chips and have to be discarded.

By the new method, the pin is first rough turned, then clamped in the fixture, Fig. 2, which shows the counterboring tool and the drill being withdrawn from the work. Fig. 3 shows the fixture open and the pin in a horizontal position, so as to show the counterbore and the tapped hole. An additional pin is shown at the left. The counterbore is driven by a No. 4 Morse taper shank.

The 1⅝-in. hole is 8 in. deep and is drilled in 9 min. 28 sec. The diameter of the counterbore is 3⅞ in. and is 1⅛ in. deep. The counterboring takes 8 min. and 42 seconds.

The tap is 1¼ in. with a 7 pitch thread, and the depth tapped is 4 in. Changing from counterboring to tapping requires 2 min. 22 sec., which is within 10 sec. of the

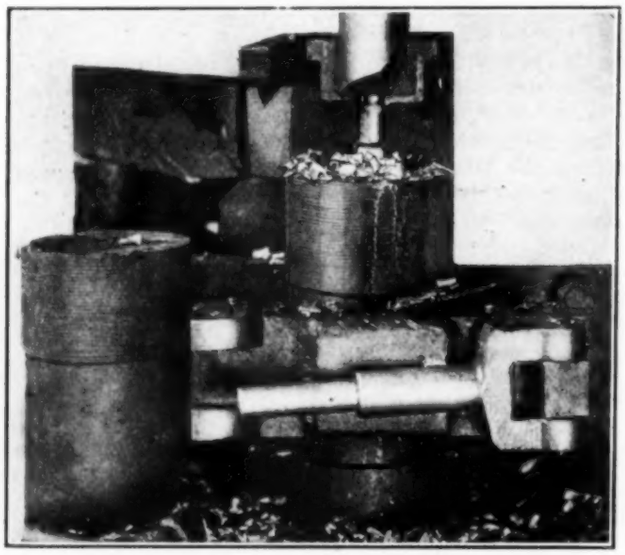


Fig. 2—Drilling and counterboring pins

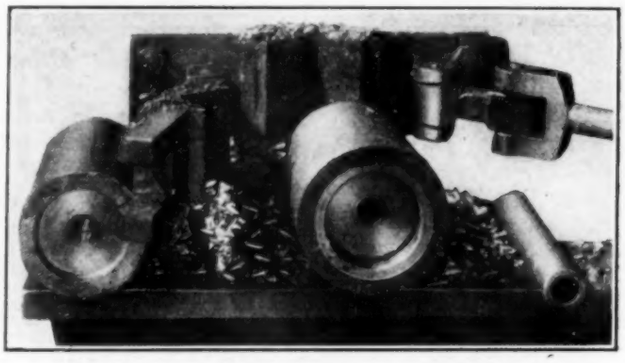


Fig. 3—The fixture open to show pin

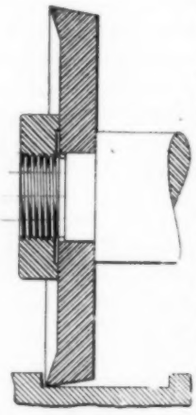
time for the actual tapping. The setting up time, which includes cleaning the drilling machine table, placing and clamping the pin, is 3½ min. and the total time for the three operations, including all handling, is 27 min. 42 seconds.

The operations are performed on a large radial drilling machine built by the Niles-Bement-Pond Co. The finishing operation is done on a lathe, the pin being held by the small end and centered by the hole at the large end. The final finishing is done by rolling. The average time for the total turning is about 58 min. The small, or driving wheel end, is left for fitting to the wheel in which it is to be used.

Cutter for Machining Corners in Hardened Steel

By S. A. McDonald

One of the shortcomings of the abrasive wheel is its inability to grind sharp corners in a recess such as can be cut with a milling cutter in soft steel. Machine designers avoid sharp corners in pieces to be ground when possible, but in such cases as the recesses for linotype molds sharp corners are necessary.



Cutter for hardened steel

A method of machining such corners is as follows: Proceed to grind the work in the surface grinder, obtaining as sharp corners as possible by dressing the wheel, then remove the wheel from the spindle and substitute the hardened, tool-steel disk shown in the illustration. The disk is brought down to the work and the automatic feed started. As the work passes back and forth, the disk is slowly fed in until it starts to cut into the fillet left by the grinding wheel. As the disk advances it will be noticed that it cuts off very fine slivers of the hardened steel. Finally a cut is taken along the whole side of the recess.

The disk is then reversed on the spindle and the other side of the recess finished in the same way. If only a few thousandths have been left for the disk to remove, it will trim the sides to gage and leave a satisfactory finish. The cutting edge of the disk will remain sharp for considerable work. The secret of a satisfactory job being to have it hard and sharply ground.

Grinding a Square Shaft to Close Dimension

By Milton Wright

The shaft shown in Fig. 1 is a part for a standard type of grinding machine built by the Brown & Sharpe Manufacturing Co. It is hardened all over and is ground to close dimension. The squared part is milled to shape before the piece is hardened and is afterward ground to size on a standard B. & S. cylindrical grinding machine in the manner shown in Fig. 2, which was made from the back of the machine in order to show a more comprehensive view of the set-up than could have been obtained from the front.

The special fixtures required are: an index plate having four locating positions; a latch, or locating piece, corresponding to the index pin; means for clamping the index plate to the shaft to be ground; and a casting to replace the regular headstock. As neither center is required to revolve, this casting can be anything that will support a dead center in line with the regular tail center, but must not extend back of this line to an appreciable extent, else it will interfere with the grinding wheel at a point diametrically opposite to the surface in action.

The index plate is clamped to the shaft to be ground by means of two opposed-taper split bushings, one fitting inside the other. The outside of the larger bushing is ground parallel to fit the hole in the index plate, and the bore is tapered to match the tapered outside surface of the smaller bushing. The bore of the smaller bushing is ground parallel to fit the round part of the shaft upon which it is for the moment supported.

The smaller bushing is longer than its mate and the protruding small end is threaded to take the ring-nut that may be seen in the picture. Slots are sawed into each bushing from alternate ends, each slot terminating in a drilled hole not far from the opposite end, so that both bushings are susceptible to slight expansion radially without interfering materially with the integrity of their outer surfaces. As all parts are ground to exact sizes after hardening and no appreciable variations are allowed, but very little expansion is needed to hold the index plate firmly on the shaft.

To change the index plate from one piece of work to another, the ring nut is turned back a quarter-turn to release the grip, when the assembled parts will slide

Fig. 1—The work to be ground

off the shaft as a unit. In place on the next piece of work and with the latter on centers, the index plate is moved endwise of the shaft until it coincides with the latch, one face of the milled shaft is set square with the surface of the machine table by the use of a try-square, and the ring nut tightened.

The grinding medium is a cup, or ring, wheel of 3846 alundum, grade H, mounted upon the end of the regular wheel spindle, the head being swivelled to bring the axis of the spindle nearly, but not quite, to a right angle with the line of work centers. The face of the grinding wheel is trued by means of a diamond mounted in a holder fixed to the surface of the traversing table, and is slightly beveled, as the departure of the spindle from a true right angle with the line of centers is sufficient only to allow that part of the grinding face that is diametrically opposite to the actual cutting point to clear the work by a few thousandths, in case the part of the work to be ground happens to be longer than the diameter of the wheel.

Grinding the first piece of a lot is a matter of cut and try. The wheel is brought into contact with the work and fed forward with the cross-feed screw to take off an amount of stock that, in the operator's judgment, will leave sufficient material for a finish cut. The table is then traversed by hand until the wheel

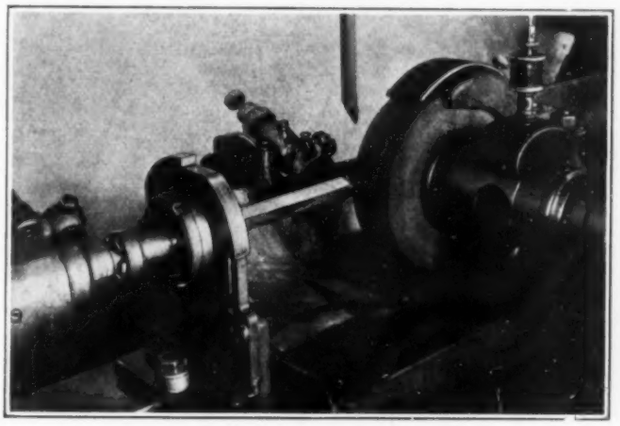


Fig. 2—The set-up for grinding

reaches the shoulder, when the table stop is set to prevent an accidental overrun in later operations.

One side of the work having been ground by three or four passes of the wheel over the length of its surface, the wheel is run off the square toward the small end of the work and the work is rotated one-half turn by turning the index plate over two notches. In this position, the side of the work opposite to the first is ground by traversing the table to the stop, and back several times without disturbing the setting of the wheel. The operator is now ready to test his tentative setting by measuring over the ground surfaces with a micrometer. If the dimension shows more than 0.002 in. oversize the operator advances the wheel, gaging the amount by means of the micrometer dial on the cross-feed screw, and tries again. Having found the right position for the wheel he then grinds the two remaining sides of the work.

The grinding wheel is then advanced by the amount necessary to reduce the shaft to dimension and the four sides are finish ground. The operator is then ready to proceed with the remainder of the lot without further delay. He knows that with the present setting of the wheel, he is safe in taking the roughing cut over the next piece, for the spring of the work under the heavier cut will surely cause enough stock to be left for the finishing cut.

The work thus resolves itself into a succession of alternate operations, roughing and finishing, without changing the setting between operations, except that it is necessary to advance the wheel by a very slight amount after each roughing cut to compensate for wheel wear. Redressing the wheel is rarely necessary, for the roughing operation breaks down the active surface, and leaves it in excellent condition for the finishing cut.

Fixtures for Planing Driving-Box Shoes

By H. H. Henson

The fixtures shown in the accompanying illustrations are used for holding driving-box shoes so that all surfaces but one can be planed at one setting.

The fixtures are made of machine steel and the sharp edges *A*, Fig. 1, are case hardened. In use, strings of fixtures are mounted in two rows on the planer table

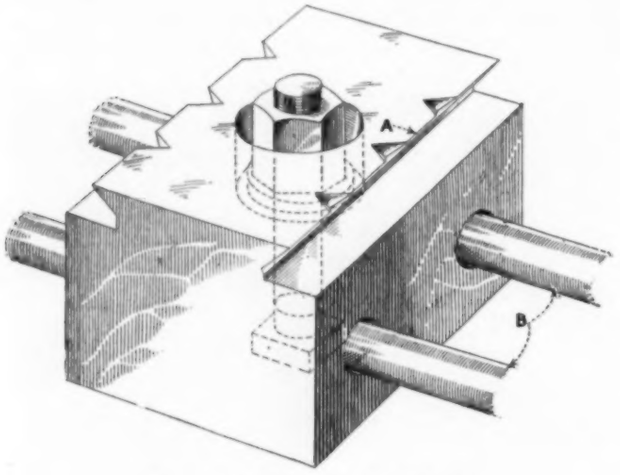


Fig. 1—Details of the fixture

so that a number of shoes can be planed at the same time. Fixtures are placed between the ends of the shoes as they are strung out on the table, and also at the ends of each row. Long tie rods, *B*, pass through all the fixtures in each row, serving to draw them and the shoes together when the nuts at the ends are tightened, forcing the sharp edges *A* into the ends of the shoes.

The number of shoes that can be planed at one setting is governed only by the length of the planer table.

Fig. 2—Planer with gangs of shoes mounted in fixtures

A planer with the fixtures and shoes mounted thereon is shown in Fig. 2, and in which the type of tools for planing the two edges of the shoes can be seen. As such tools will drag on the work on the return stroke of the planer, it is necessary that they be lifted at the completion of the cutting stroke. To accomplish the lifting, a small air cylinder was mounted on the planer housings above the cross rail and connection made by cords between the piston and the tools. A 3-way cock in the air pipe, operated by the reversing lever, makes the tool lifting and dropping entirely automatic. The operator is thus relieved from unnecessary work.

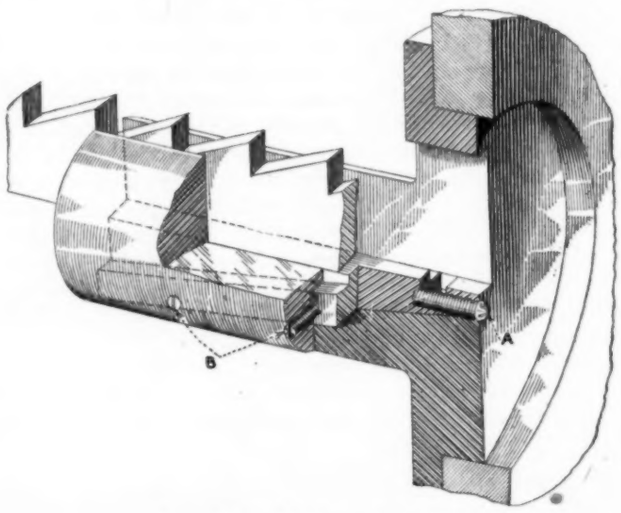
Broach Guide with Adjustable Shoe

By W. Burr Bennett

Broach guides, especially those used in connection with keyway broaches, are susceptible to wear at the bottom of the slot in which the broach slides, and wear at this point immediately results in lessened depth of cut taken by the broach. Hardening the guide may overcome the trouble in some degree, but a hardened guide places the broach in greater danger of being broken and, therefore, most of them are left in the soft state.

To avoid the complication likely to be introduced by hardening the guide, and at the same time to increase the wear-resisting qualities of the guide and provide means for compensating for such wear as will inevitably take place, I would present the device shown in the accompanying sketch; well appreciating the fact that it is not applicable to guides that are to be used in connection with very small holes, for the reason that there is not sufficient metal left at the bottom of the slots in such guides to accommodate the steel shoe.

The bottom of the slot in the guide is planed at a suitable angle to the axis of the guide and widened



An adjustable broach guide

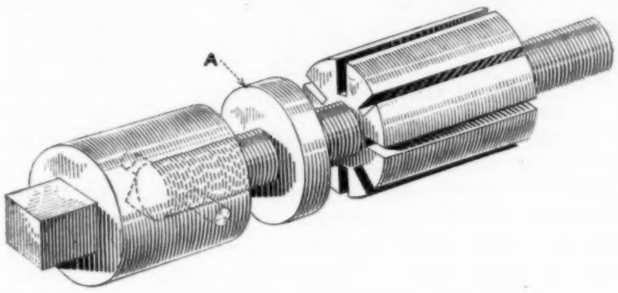
at the sides in the same plane to accommodate a steel shoe of corresponding shape that is fitted to slide freely up and down the slot. The top of the shoe is to be planed parallel with the axis of the guide, and thus becomes the bottom of the slot in which the broach is to slide.

The shoe abuts against a headless setscrew, tapped into the inner face of the guide at *A*, and by it is prevented from accidental movement while in service. It is further secured by setscrews tapped into the side of the guide at *B*. To readjust the shoe to compensate for any wear that may have taken place, the setscrews *B* are loosened, the setscrew *A* given a slight turn backward and the shoe again brought to bear upon it; after which the setscrews *B* are again tightened.

Locating a Blind Pin by Magnetism

By Roger S. Pyne

The other day I had occasion to make a repair upon an expansion reamer the threaded body of which was obviously screwed into the shank as indicated in the sketch, and to make the repair it was necessary to break this joint in order to remove the ring nut *A*, which was



The reamer with the hidden cross-pin

between the two shoulders. The shank was smoothly ground to the nominal diameter of the reamer and there was no evidence of a cross-pin, even under a powerful magnifying glass. Nevertheless, as repeated efforts had failed to start the joint, I suspected that such a pin existed.

I carefully dusted over the polished surface of the shank with dry dust from a near-by grinder, stood the reamer on end on a magnetic chuck and turned on the current. Instantly there appeared on opposite sides of the polished surface small, sharply-defined circles that revealed beyond question the location of the hidden pin.

Flow of Metal Under Pressure

By Clifford H. French

I recently ran across two interesting examples of the way in which steel will flow under pressure, and cold at that.

One was in the making of molds or dies for bakelite and similar materials. Some of the molds were for the dials used in radio sets, others for electric lighting plugs and switches, and a variety of other things such as hair-brush backs and similar articles.

Instead of engraving the molds in steel as was formerly done, or using the method of the silverware manufacturers, of forcing a pattern into a heated steel block under a drop hammer, they are now made by forcing a master punch into a cold block of low carbon steel. The radio dial, for example, is engraved with all the desired graduations, on a block of some good steel and hardened. The punch or force and the block of soft steel which is to be used for the mold are then placed in a hydraulic press and the punch forced into the steel, sometimes to the depth of a half inch or more. On extremely deep impressions the block is sometimes annealed after the punch has been forced in half or two-thirds of the way.

If the pattern is of such a nature that the metal can flow sidewise without danger of breaking the punch, the soft steel block need not be confined in a holder, and in such cases the pressure required is about 50 tons per sq.in. of surface. When however the block is confined it requires about double this pressure or 100 tons per sq.in. If the punch used to force the impression into the block has prominent projections, the block must be confined against side movement or the spreading of the block under pressure will split the projections from the punch and ruin it.

The other of the examples referred to is the case of the lining in a large hydraulic press. The finished bore was 24 in. and the length of the liner about 40 in., the thickness being ½ inch.

This liner was turned 0.005 in. larger than the bore and was forced in with 150 tons pressure, white lead being used as a lubricant to prevent sticking. Then the liner was rolled by two heavy rolling tools so as to force it into intimate contact with the bore at all points, enlarging the diameter about 0.015 in. in the rolling. A very light finishing cut was taken and the surface again rolled but with a light pressure, just to burnish the surface.

The interesting feature of this rolling however is that it *lengthens the steel lining over half an inch*, forcing it out in spite of the tightness of the fit in the cylinder.

Automobile Piston Clearances—Discussion

By Douglas P. Muirhead
Glasgow, Scotland

I notice on page 382, Vol. 59, of the *American Machinist*, a letter from James McIntosh relating to the subject given above, in which he states that the figures I have given are of no value, as they do not take account of all factors controlling piston conditions. This statement is incorrect, as the figures are based on the actual test-bed conditions and therefore take account of practically all factors. Mr. McIntosh states that the volume of metal in the head of a piston is, up to a certain point, of value in transferring heat to the skirt, and that beyond this point, a thick piston head is a detriment. This is only partially true, as he could easily find out by examining some of the good designs of aluminum pistons.

I would like to refer Mr. McIntosh to the letter on Piston Clearance by E. Jackson, on page 392, Vol. 59, in which Mr. Jackson agrees that the figures I gave are satisfactory.

Getting the Drill Ground Right

By Charles D. Folsom, Jr.

When drilling through solid metal, your drill must be ground quite accurately, if the hole is to be close to size. If the drill is not smaller than about ⅜ in., and if it has a center hole in the butt end, there is a quick and convenient way of finding whether or not it is ground right before starting the hole.

Holding the butt end of the drill back against the tail center of a lathe, make a little scratch with one of the lips on the compound rest or other convenient rigid object; then turn the drill and make a scratch in the same place with the other lip. If the scratches do not coincide, one lip will cut before the other and will force the drill to one side, making it cut over-size. If the scratches do coincide, the lips are all right; and if you check up the angle of the drill point by looking at it carefully, and by measuring the distance from the extreme point to the lips with a scale, your drill is likely to cut pretty close to size.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN

Editors

January 31, 1924

High Surtaxes and Large Gold Reserves

IS THERE any connection between the enormous gold reserves of the United States and the high surtax rates imposed by the Internal Revenue Act? This is a question which has been puzzling us for some little time. We have lots of company when it comes to worrying about either one alone but so far as we know we are pretty much alone when it comes to considering the two together.

According to the figures quoted in an article in one of our best economic weeklies, forty-eight per cent of the monetary gold of the world belongs to the United States. If all of it were deposited in the Federal Reserve Banks, the reserve ratio would be well over one hundred per cent and there seems to be a steady flow of gold in our direction from other countries. Economists of several nations have looked with foreboding at the continual increasing hoard of idle gold. Some of them insist that gold as a monetary standard has gone into the discard and point with concern at the carefree way in which certain government printing presses are turning out paper money. Probably the people who believe that the gold standard is disappearing do not give due consideration to the fact that the American dollar, based on a gold reserve, is rapidly becoming the standard of exchange in such a country as Germany where the local paper currency diminishes so rapidly in value.

When one looks at the tremendous supply of gold in our bank vaults and then at the lack of expansion in many of our industries the natural question that comes to one is why do not the enterprisers of the country borrow some of this gold and put it to work? Probably there are many reasons differing somewhat in each particular case, but isn't the one reason that is the same for all cases the fact that high surtaxes have killed most of the aggressive initiative of many American business men?

The inauguration of new enterprises means hard work. It is a wonderful game, stimulating and absorbing, but nevertheless a difficult one. If the government is going to take by taxation the difference between the possible profits and the interest return on tax-free securities where is the incentive to do otherwise than invest in such bonds?

Perhaps there is no connection between these two important factors in business life and perhaps the solution of both problems would not be aided by a scientific tax revision such as that proposed by Secretary Mellon but until someone takes the trouble to prove tc us that there is no connection we are likely to maintain our belief that there is.

Two Interesting Ten-Year Programs

IN A SURVEY made by *Electrical World* at the beginning of the year it was discovered that if the building and equipment programs of the central power stations of the country for the next ten years were all added together the sum total would be, in round numbers, six billion dollars. This figure is about as accurate a forecast as can be made in any industry as each company has a pretty fair idea of the amount of power it is going to be called upon to provide in the years ahead and most companies plan at least ten years in advance to care for necessary financing.

At the recent regional meeting of the Chamber of Commerce of the United States at Philadelphia, the statement was made that in order to provide adequate transportation for the expanding needs of American industry for the next ten years an expenditure for trackage and equipage involving eight billion dollars would certainly be required. In the railroad field, of course, the figures are probably not so accurate because the railroad people cannot foretell the affect of adverse legislation on their development. They can, however, lay out exterpolated tables or curves of transportation growth and estimate how much additional trackage and how many additional cars and locomotives will be needed to take care of it.

Here are two basic American industries, many of whose needs must be met by the men who build and use machine tools and small tools. The machinery industry has always suffered severely from wide fluctuations between poverty and prosperity but in the long run it can look forward to a great deal of work to be done in at least two big fields of effort.

New Work for Parts Builders

THE building of transmissions and other parts for buses promises to offer a new opportunity for parts makers. In many cases passenger car parts are being taken over by the builders of automobiles instead of being purchased in quantities as formerly. But the development of bus transportation promises to afford a new lease of life to some parts plants where the sales department was beginning to have hard work to keep the orders coming in fast enough.

Experience has shown that the bus instead of being a glorified truck presents a new problem. For, while the vehicles are heavy and carrry a goodly load of passengers they must maintain a good speed, be easily handled and be reasonably quiet in operation. Generally speaking, many of the units designed for truck use have not been satisfactory and new parts have had to be designed.

There is also a tendency for a greater range of speeds than the proverbial "three forward and reverse" for both trucks and buses. Some of the later designs of transmissions have five speeds forward and two reverse, the latter being especially for truck use.

Motor transportation has so many possibilities that wide awake builders of standard units are likely to find plenty to do for some years to come.

Shop Equipment News

Ingersoll Cylinder Boring and Reaming Machine

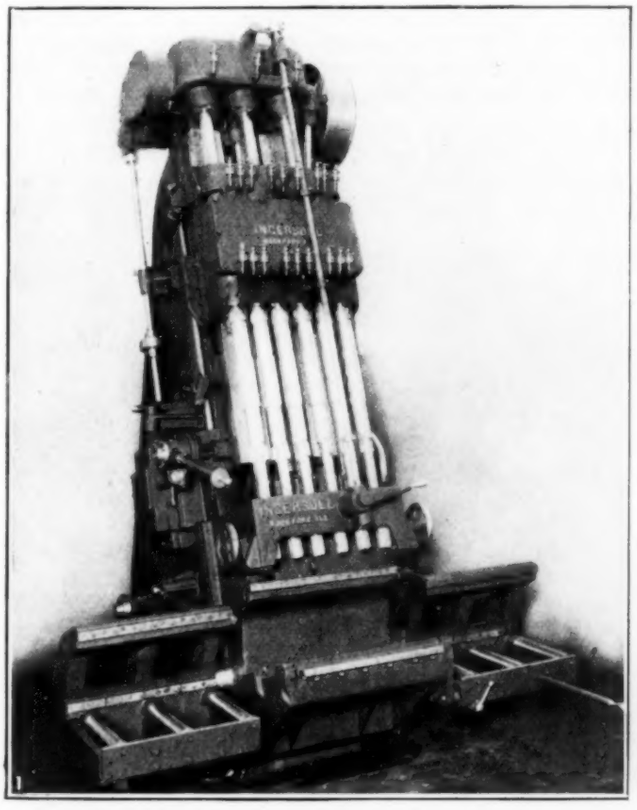
A machine designed especially for use in boring and reaming automotive cylinders has recently been developed by the Ingersoll Milling Machine Co., Rockford, Ill., and is now being marketed. The machine is of the inclined type, made with four, six or eight spindles as desired, and is fitted with two roller conveyor sections, called the "cradle."

The conveyor sections, shown at the bottom of the machine in Figs. 1 and 2, are both attached to one shaft and are counterweighted, a handle being attached to the front of one section so that the cradle can be aligned with the conveyor line to receive and discharge cylinders, and also aligned with the machine table to change the pieces in the machine.

Power is delivered from the pulley shaft at the top of the machine through gears to a worm drive shaft, and thence through worms and wormwheels to the saddle drive shafts, each of which drives two spindles, the power being transmitted through herringbone gears. Each spindle drives a line boring bar which is piloted in both the upper and lower bushings in the fixture as shown in Fig. 3. The bars are provided with hardened steel adjustable wearing strips and the cutters are of the block type with adjustable blades.

The feed mechanism is driven by a shaft from the upper gear box, and a rapid traverse is provided by which the saddle can be raised or lowered quickly to the desired location. The feeds and the rapid traverse are both controlled through one hand lever on the left side of the machine, the gearing being arranged so that when the lever is raised, the saddle is raised by the rapid traverse. When the handle is locked in the "down" position, the saddle is lowered in the same manner and, by moving the lever to either side, the desired working feed is obtained. This arrangement precludes the possibility of confusing the directions in which the lever should be operated, and makes it impossible to mesh two sets of gears simultaneously. All operating and loading control levers are within easy reach from the operator's working position, so that he does not have to move from the front of the machine.

The saddle is counterweighted to eliminate unnecessary wear and waste of power, and if so desired, the spindles can be held stationary while the saddle is being moved up or down by the rapid traverse. Pick-off gears make it possible to change the speed as desired, and the feed is



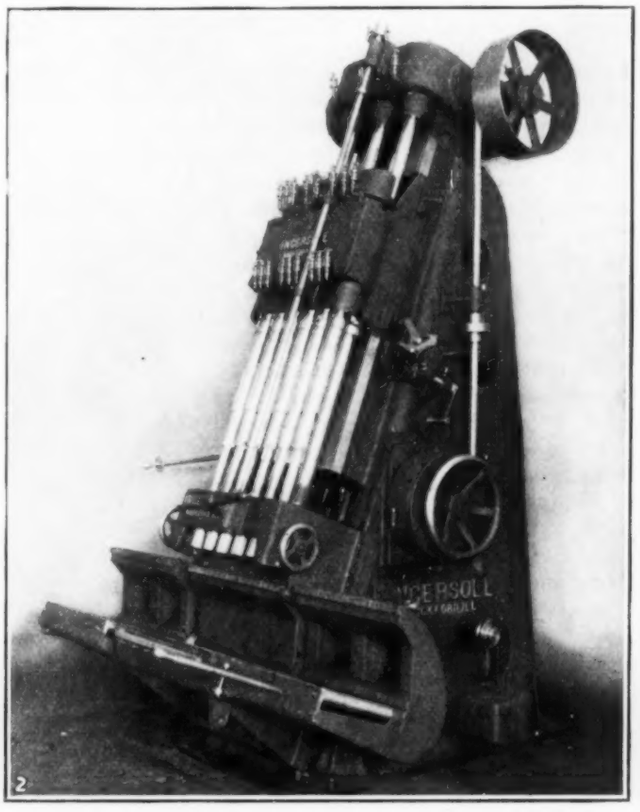


Fig. 1—Ingersoll Cylinder Boring and Reaming Machine. Fig. 2—View of right side showing cradle aligned with machine table

determined by the requirements of the job. A shear pin is provided in the vertical feed shaft so that any blocking of the cutters will cause the pin to shear before the cutters or gears are broken.

The machine table shown in Fig. 3 carries two dowel pins for locating the cylinder block in position. When the cradle is raised so that a cylinder block can be placed in position or removed, the dowel pins lower beneath the level of the table. After the piece is in position and the cradle lowered, the dowel pins rise and

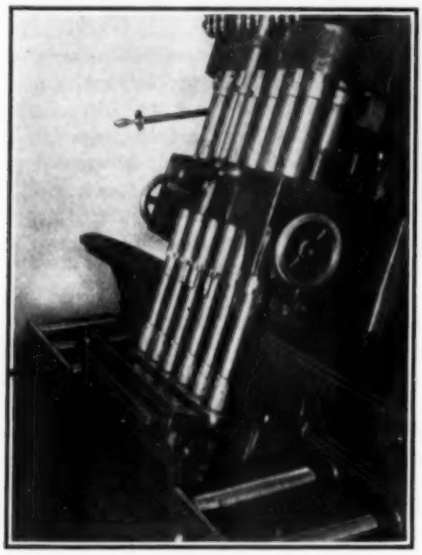


Fig. 3—Spindles in position for boring

enter the locating holes. The machine table and loading cradle can be made to suit the requirements of any conveyor line. The piece is clamped in the machine by either of the small hand wheels shown, the hand wheel shaft operating worms and gear sectors which act as clamps at each end of the cylinder.

The machine is built on the unit system, and any unit can be removed without disturbing the others, every unit being easily accessible. The bearings in the upper gear box are all of the ball and roller type. The upper ends of the spindles run in SKF thrust bearings which can be adjusted from the outside.

A geared pump in the drive gear box pumps oil to all gears in the gear box, the feed box gears being oiled by splash lubrication. Individual sight feed oilers are located on each saddle bearing, and the possibility of oil leaks is diminished by the use of stuffing boxes. Either belt or motor drive can be supplied. The weight is 15,000 lb., and the floor space required is 5½x7 feet.

National Acme 9/16-In. Model C Automatic Screw Machine

The five-spindle, ⅝-in., model C automatic screw machine now being marketed by the National Acme Co., Cleveland, Ohio, incorporates a number of improvements and betterments over the former four-spindle models. The main principles of the machines formerly manufactured by this company are, however, retained.

A front view of the machine is shown in Fig. 1, and it is apparent that a spindle-carrying head mounted at the left end of the frame encases the work spindles. This head is indexed step by step, bringing the spindles into five successive positions for the progressive cutting operations. Tools are mounted on the main tool slide at the center, and also on the cross-slides located directly in front of the spindle head.

The machine has capacity for ⅝-in. round, ⅝-in. square, or ⅝-in. hexagonal bars. The maximum length of feed is 5 in., and the regular turning length is 4½ in. The speed of the countershaft is 385 r.p.m., giving a normal range of production from 300 to 3,000 pieces per hr. The machine may be belted to a countershaft or driven by an independent motor, as shown in Fig. 1, at the right.

The power for the spindle drive is transmitted through interchangeable gears to a center shaft which passes through the main tool slide to the center of the spindle head. The change gears are provided for changing the spindle speeds. The camshaft is also driven from the gear box at the right-hand end of the machine, and a clutch shaft is arranged to give fast or slow speed to the worm gearing on the camshaft.

The main tool slide is shown at *A*, Fig. 2, and is supported by a hardened and ground slide extension *B*, which telescopes into the spindle carrier. To further insure rigidity, a rear support sleeve *C* is mounted in a heavy bearing, and an extension *D* is arranged to travel along a hardened and ground steel plate. The push rod for moving the slide is attached to this extension, as shown.

The spindle carrier casing *E* is counterbored at *F* to provide for end thrust of the cylinder. The cylinder is supported in ample bearings at either end of the casing and the spindle drive gears are located in cored spaces in the cylinder.

A modification of the Geneva-stop motion is used to index the spindle carrier. The cam *G*, Fig. 3, engages successively with three rollers on an index gear, and this gear meshes with the cylinder gear, indexing the cylinder through one-fifth of a revolution. At a production of 3,000 pieces per hr. the spindle carrier is

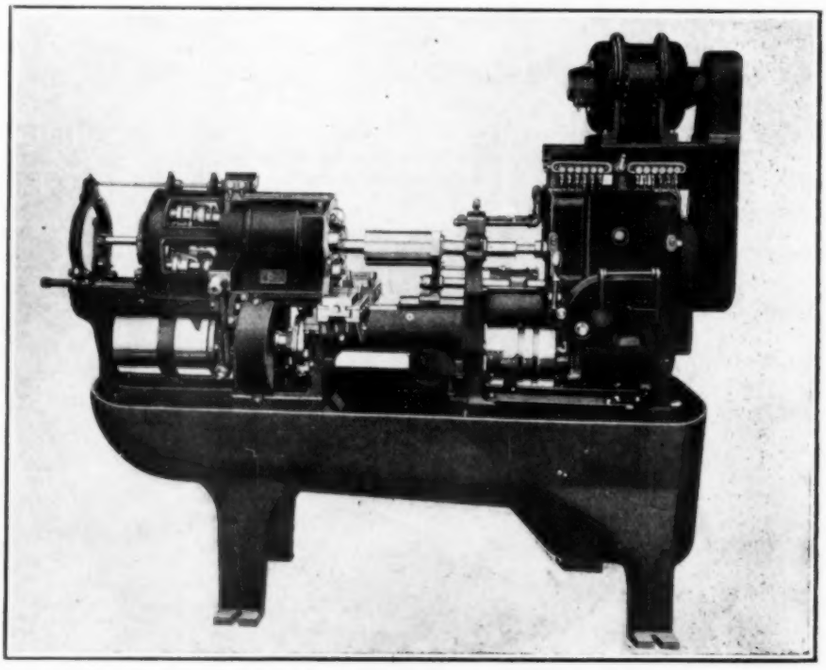


Fig. 1—National Acme ⅝-In. Model C Automatic Screw Machine

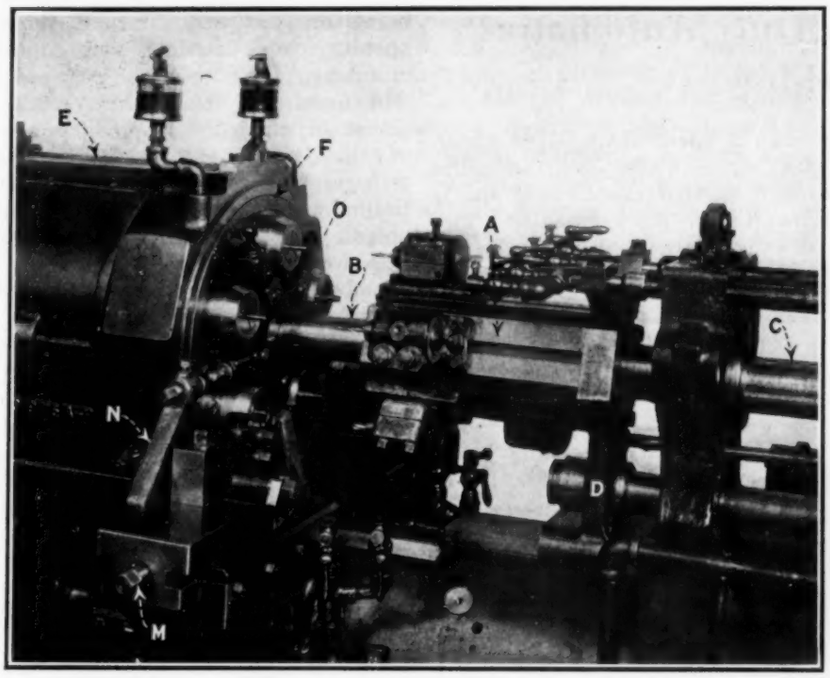


Fig. 2—Spindle head and tool holders

indexed almost once a second, and it is claimed that this mechanism causes the carrier to start without shock, turn rapidly and come to rest in position without excessive strain or shock.

A heavy lock and latch bolt system is provided to lock the carrier in position. The latch bolt is located at the rear of the machine, the lock bolt being in front and shown at *H*, Fig. 3. The lock bolt operating lever *I* is actuated from a drum on the main cam-shaft, and both latch and lock bolts have a tendency to pull the cylinder down in its bearings, so that it is held solidly and in good alignment with the various cutting tools.

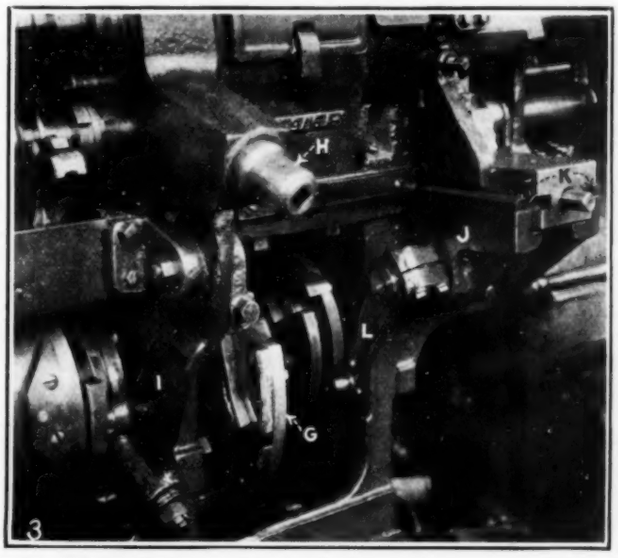
The forming and cut-off slides are mounted on heavy brackets cast integral with the bed as shown at *J*. Hardened and ground steel plates *K* are provided to guide the slide, and the motion of the slide is transmitted from the cam through the lever *L*. Both cut-off and forming slides are of the same size and double-deck tool holders can be economically used for double forming, knurling, shaving, etc. To allow the adjustment of the tools without loosening tools or holders endwise, an adjusting screw *M*, Fig. 2, is provided.

As a precaution against the overtravel of the forming tools, the bracket *N*, Fig. 2, is located on the forming slide. A stop bracket having five arms is also located between the work spindles at *O*. These brackets carry adjustable studs by means of which the distance of cross-slide travel for each individual spindle may be definitely and accurately fixed.

By simply changing the position of the stock-feed dog, the feeding of stock can be done in either the first or fifth spindle position, and for long feeds the feeding can be done at both positions. The stock feed slide is shown at *P* in Fig. 4, and is guided by two longitudinal rods *R*. The slide is actuated by a cam roller direct from the main cam drum.

The chuck operating slide *S*, Fig. 4, also moves on the same guide rods *R* and is operated directly from the drum. The feed tubes *T* are supported in the disk *U* to prevent whipping at high speeds, and the return ring *V* brings all back into the disk and against the plate *W*. In this position the tubes are guarded from displacement during the indexing motion of the spindle carrier. The holding bolts for the plate *W* pass through slots *X* so that the plate can be turned when the spring tension is released. The stock pusher may then be removed through the notches in the plate, the plate springing back into position automatically when released.

The floor space required is 32 in. in width and 7 ft. in length, without the stock reel. The belt-driven machine is 58 in. in height, the motor-driven machine shown in Fig. 1 being 12 in. higher.



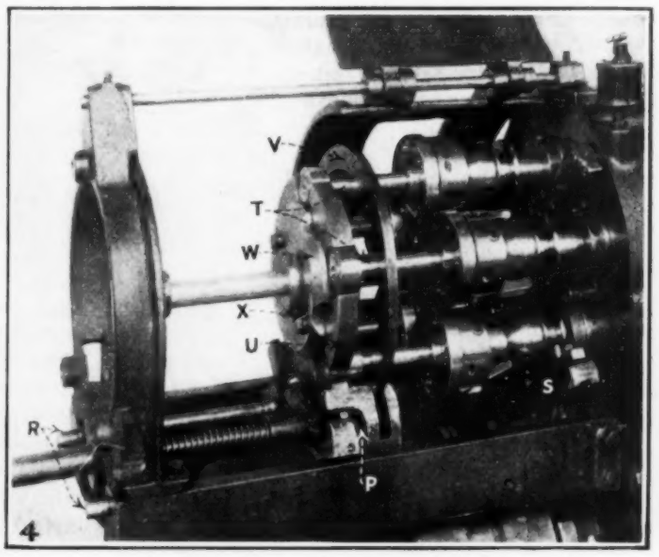


Fig. 3—Spindle head and cross-slide mechanism *Fig. 4—Stock feeding and chucking mechanism*

Budd-Ranney Heavy Duty Automatic Bar Machine

An automatic bar machine, intended for high production work on the simpler screw machine products, is now being marketed by the Budd-Ranney Engineering Co., 44 East Chestnut St., Columbus, Ohio. The products particularly adapted for manufacturing operations on this machine are those requiring longitudinal drilling, such as nut blanks, bushings, chain rollers and pipe couplings.

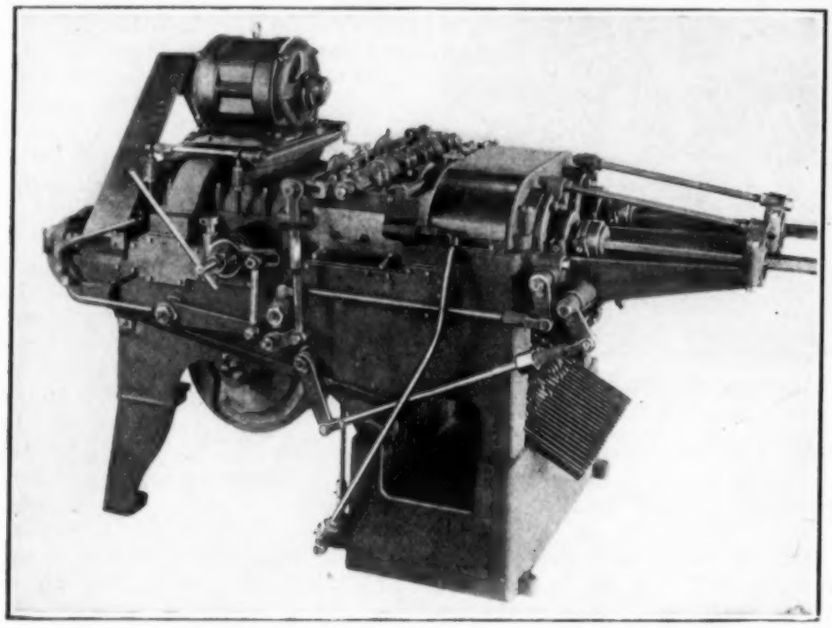


Fig. 1—Budd-Ranney Heavy Duty Automatic Bar Machine

As shown in Fig. 1, the machine is arranged to cut off, form turn, drill, counterbore and box turn articles which can be finished in a single cut. The machine illustrated is set up to make nut blanks from hexagonal bars, an operation to which it is especially adapted. It is of the double-spindle type as are two others of the range of sizes furnished, the fourth and largest size having but one spindle.

The No. 1 size has a maximum capacity of 1-in. round or $\frac{7}{8}$-in. hexagonal bars, the machining length being 1 in. The No. 2 machine will handle up to $1\frac{1}{2}$-in. rounds or $1\frac{1}{4}$-in. hexagonal, $1\frac{1}{4}$ in. in length, and No. 3 and No. 4 have capacities for $2\frac{1}{2}$-in. and 4-in. rounds, or $2\frac{7}{8}$-in. and $3\frac{1}{4}$-in. hexagonal bars, respectively.

The machine is motor driven, the motor driving the clutch shaft through a silent chain. The clutch shaft drives the drill spindles through another silent chain and is geared to the stock spindles. Two disk cams are located under the bed of the machine below the drill spindles, one for opening the chuck, the other controlling the cutting movements. The main cutting cam is grooved so that no springs or counterweights are necessary to return the tool holders to the starting point. Both cams are driven through worm gearing. The cutting cam is so constructed that the cutting tools are in action for 86 per cent of the cycle, the remaining time being consumed in tool return, chuck opening, work feeding and chuck closing.

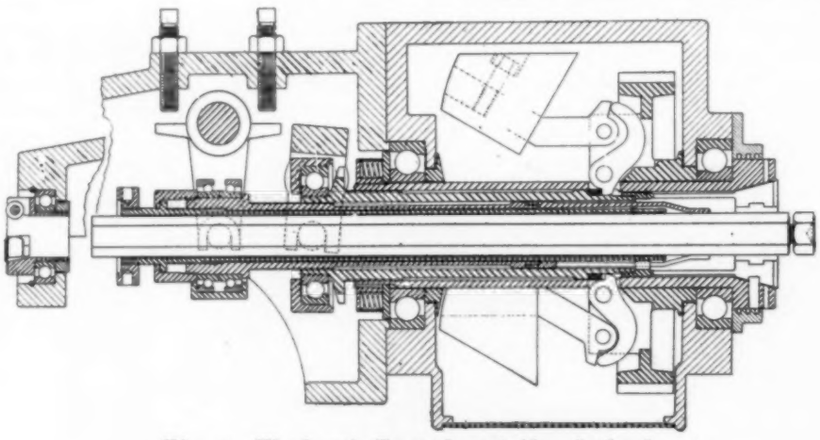


Fig. 2—Work spindle and centrifugal chuck

A feature of the machine is the chuck, in which the gripping power of the jaws is obtained by centrifugal force. Fig. 2 shows a longitudinal section through the stock spindle and the chuck mechanism. The weights shown in the weight chamber are sufficiently heavy to provide a firm grip of the jaws.

It will be noted that the centrifugal chuck is never closed when the machine is not running, no matter what the position of the cam may be. Fig. 2 also shows that the chuck collet is splined on the feed tube, this construction holding the stock centered with the chuck opening and preserving accuracy of feed through the elimination of friction at this point. No feed stops are provided, the length of feed being governed by the length of the feed stroke only.

An inner tube is provided for the purpose of expanding the feeding fingers when entering or withdrawing the stock or setting up the tooling for a different product. This inner tube is threaded into the feed tube and is advanced or withdrawn by turning a spanner nut attached to its rear end. The spindle assembly is mounted in heavy ball bearings of the combined radial and thrust type, the rear bearing retaining nut being furnished with springs which prevent floating of the spindle regardless of bearing adjustments and, at the same time, provide necessary freedom for expansion and contraction due to temperature changes.

The drill spindles are arranged directly in line with the stock spindles as shown in Fig. 3, which is a top view of the machine with the platens for the cutting-off and forming tools

swung up to the position which they occupy for tool inspection or replacement. Fig. 4 is a section through the drill spindle and shows the detailed construction. The feeding sleeve *A* is moved longitudinally by the cam-actuated pinion *B*, carrying the splined drill spindle *C*. The driving gear *D* revolves the spindle and an ejector for the drill is shown at *E*.

The part *F* is a combined drill guide and box turning head. This device is moved up to the work by a cam and carries a drill bushing and a counter-bore. It has a channel *G* through which the cutting compound is introduced. The motion of the head is derived from the main cutting cam, an interchangeable character cam being inserted in the linkage to suit different varieties of work. In making nut blanks the head advances and does the counterboring, tarries and centers the drill, and then backs away rapidly to provide chip clearance. When the blank is drilled off and the drill backs away, the head again advances and strips the blank off the drill. The character cam for this head is the only one cut the blank entirely off the bar, as it is drilled off later. After the cut has been made the stock is fed forward for the drilling and counterboring operations, the cutting tools meanwhile preparing another blank.

A forming tool for chamfering, or forming castellated blanks, may be mounted beside the finishing cut-off tool. The positions of all tools are positively located and necessary standard adjustments are convenient and simple.

When the tool platens are swung into position an inclosed cutting

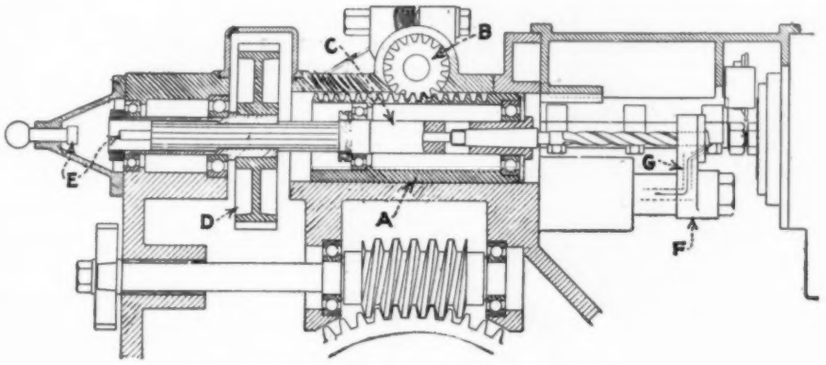


Fig. 4—Sectional view of drill spindle

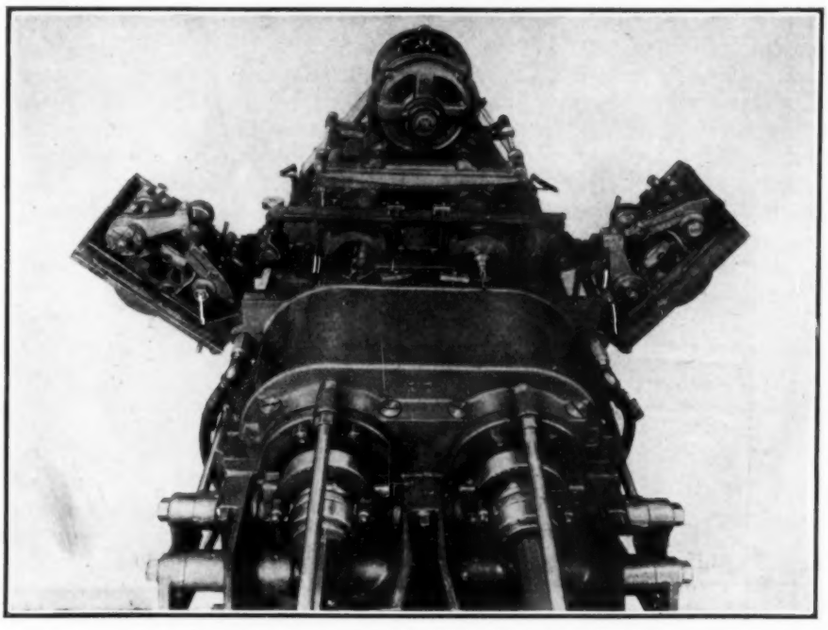


Fig. 3—Top view of machine with tool platens up

changed for different sizes of work.

The cutting-off and forming tools are mounted in holders which are pivoted on the hinged platens shown in Fig. 3. The holders are actuated from the main cutting cam through linkages located at the side of the machine, and cutting compound is supplied independently to each tool. The cut-off tools perform their functions on the blank first, but do not

chamber is obtained and a water- and vapor-proof electric lamp is mounted inside to permit observation of the tool action through the splash without shutting off the coolant supply. A heavy air draft through the cutting chamber is supplied by a motor-driven fan, preventing the formation of steam.

Standard tooling arrangements and feeds and speeds have been determined, by the use of which it is claimed that the tools should operate for about 55,000 lineal ft. of cut before regrinding. This means a production of 36,000 ¼-in. nut blanks at 2,400 per hr., or 3,800 1¼-in. blanks at 450 per hour.

The machines weigh 4,500 and 7,500 lb., respectively, for the No. 1 and No. 4 machines, the other weights being intermediate. The width of the largest two-spindle machine, No. 3, is 6 ft., No. 1 and No. 4 being 4½ ft. wide.

The driving motors required for these machines range from 5 hp. for the No. 1 to 15 hp. for the No. 4 size. The motor speed is 1,800 r.p.m., except for the No. 4, which runs at 1,200 r.p.m. The independent coolant pump motors are ¼ hp. for Nos. 1, 2 and 3, and ½ hp. for No. 4. The cooling fans are similar to the ordinary desk type and range from 10 to 16 in. in size. Properly guarded stock supports are furnished.

Noble & Westbrook Dial-Feed Marking Machine

The Noble & Westbrook Manufacturing Co., Hartford, Conn., has recently brought out a marking machine for stamping sizes, trademarks and other designs upon bushings or similar cylindrical pieces of various diameters and lengths. It is simple and positive in its action, has no reversing or reciprocating parts, and the work travels continuously in one direction from the feeding-in chute to a receiving receptacle.

The steel stamp is attached to the face of a small vertical slide, seen in the illustration at the top of the machine, and when once set to a given diameter of work, has no movement. By loosening a single binding screw, however, the stamp may be adjusted vertically by means of a

small hand-wheel, to make the impression lighter or heavier, or to set the stamp for another size of work.

The principal moving part of the machine is the feeding dial, which is a disk of tool steel, hardened and ground and having a number of V-shaped notches across its periphery. Thinner disks of soft steel position

Noble & Westbrook Marking Machine

the work-pieces endwise as they roll from the feeding-in chute into the notches of the continuously-rotating dial.

The active face of the stamp is slightly concave to conform to the arc described by the outer surface of the work-pieces as they are rolled under it. As the work pieces pass under the stamp, the outer surface of each is stopped by it and the piece thenceforth rotates in its V-shaped seat in the dial, in the same manner that the pinion of a planetary gear train rolls between the central driving gear and the outer ring-gear.

The dial is driven through back-gears from a pulley at the rear of the machine, these gears having a ratio of 1 to 15, so that ample power is supplied by the 2-in. driving belt. The capacity of the machine is for bushings or similar pieces from ¼ to 1¼ in. in diameter and of any length up to 1½ inch. Other diameters can be handled by the same machine by substituting another dial, and longer pieces by packing the outer retaining disk away from the dial.

The output is determined solely by the ability of an operator to keep the chute filled with work, and from 6,000 to 7,500 pieces per hour is a comfortable working speed.

Gould & Eberhardt No. 16HS Gear Hobbing Machine

A No. 16HS manufacturing hobbing machine, especially suited to the production of standard gears in quantity and readily adaptable for a diversified range of work, has recently been added to the line of machines manufactured by Gould & Eberhardt, Newark, N. J. In the design of the machine, the operating side of which is shown in Fig. 1, particular attention has been paid to the proportions and arrangement of the component parts, so that a large production of accurate gears at very fast speeds and feeds can be maintained.

A heavy column or stanchion is arranged to slide on ways machined on the top of the bed, and can be adjusted to the position required by the diameter of the gear being machined. The hob spindle is mounted in a carriage which slides vertically on the face of this column, and is moved by means of a feed screw located between the ways.

The vertical work spindle is located in the bed of the machine at the left-hand end, the top of the spindle being obscured by the splash guard in Fig. 1. The outboard support for the work arbor consists of a box-section column attached to the bed and carrying an arbor supporting arm which can easily be moved upward and swung out of the way when removing the finished blanks.

The arrangement for the transmission of power to the cutter and work spindles is simple and sufficiently flexible so that the machine may be adapted for work on spur or helical gears of different pitches and tooth numbers. A diagrammatic view of the drive mechanism is shown in Fig. 2, and it will be noted that the point of application of the power delivered by the pulley shaft is so arranged that the flow of power to the two spindles is substantially equalized. This is intended to utilize and balance the normal backlash of the parts.

The mechanism between the spindles consists of three shafts and four pairs of gears, the power being transmitted to each spindle through two pairs, one of which consists of a worm and wormwheel. The wormwheels are mounted directly on the spindles. Heat treated alloy steel gears are used practically throughout the machine, and are connected to their respective shafts by multiple splines. The spindle worms are hardened and ground and the hob spindle wormwheel is made of a special bronze alloy, the index worm-

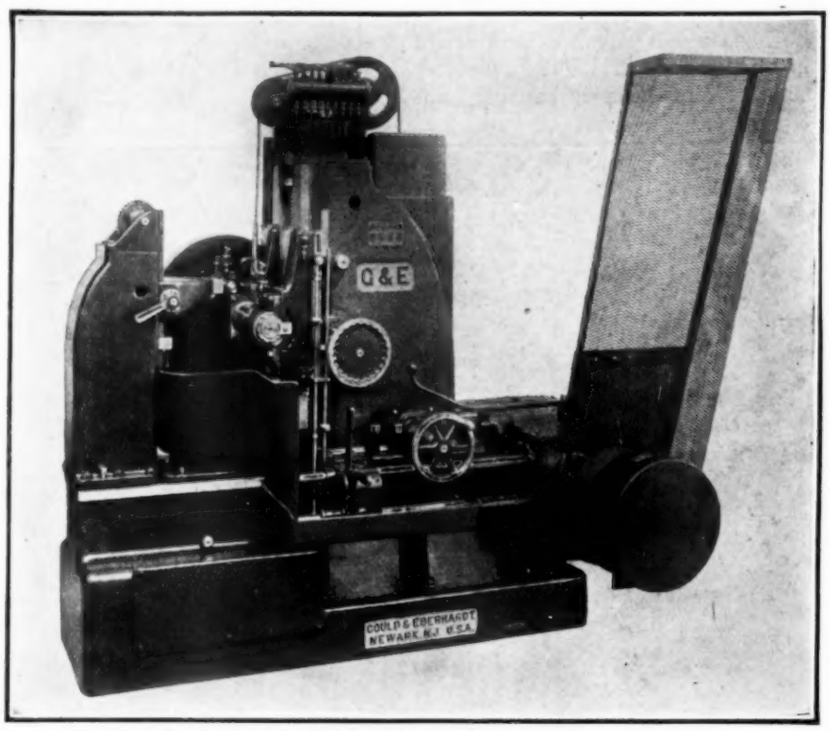


Fig. 1—Gould & Eberhardt No. 16HS Gear Hobbing Machine

wheel being of chilled cast iron. Due to the accuracy of the drive mechanism, the angular velocity ratio between the two spindles has been found to be exceptionally uniform.

As shown in Fig. 1, the operating controls of the machine are located within easy reach of the operator, so that he does not have to move from the position occupied while loading and unloading the machine. A long lever with a ball end controls the main transmission clutch for starting and stopping the machine; another engages the power rapid traverse in either direction for the hob carriage; and a third starts and stops the feeding motion of the carriage. A handwheel is provided for adjusting the position of the carriage, and another for positioning the column for the proper depth of cut, or for different diameters of gears.

The rapid traverse rate is 100 in. per min., and is available whether the spindles are operating or not. The operating lever is interlocked with the feed lever so that both cannot be engaged at the same time, and the operation of the rapid traverse at any time in either direction will cause the feed to be disengaged.

Fixed stops are located to determine the extreme movement of the hob carriage in either direction, and an adjustable stop is also provided to stop the upward movement of the carriage at a position convenient for the loading and unloading of the blanks on the work spindle. In order to make it possible to bring the cutter to the blank quickly by means of the rapid traverse, without the danger of running the hob into the work, a bell-crank and cam device is arranged to disconnect the downward rapid traverse at any desired point. This device also prevents the reengagement of the rapid traverse during the cutting operation. When the cutter has been brought to position for starting the cut and automatically stopped, the feed is engaged and continues until the lower adjustable stop is reached.

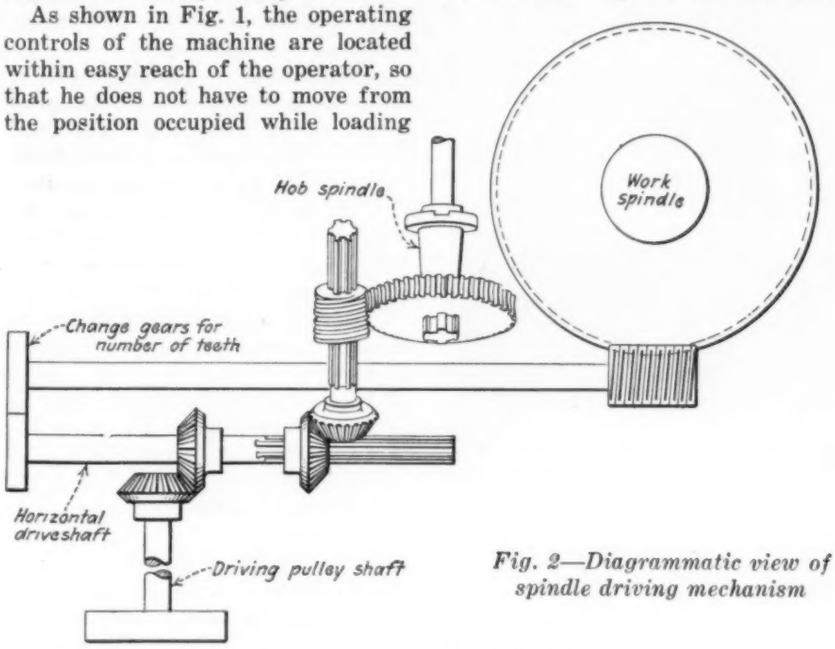


Fig. 2—Diagrammatic view of spindle driving mechanism

Automatic flood lubrication is provided for the work spindle worm and most of the other revolving parts. The lubricant is pumped to an elevated reservoir from which it flows by gravity to a settling chamber, flooding the gears and bearings in its passage. Sight-feed and multiple gravity oilers are used on the other parts of the machine.

The end thrust of the hob spindle is resisted by a thrust bearing close to the hob to eliminate any axial movement of the hob caused by the elongation of the spindle when running warm. The spindle is made of heat-treated alloy steel and is mounted in hardened taper bushings which run in bronze bushings. The bearing at the end of the spindle opposite the driving worm is easily removable for the mounting of the hob, the maximum diameter of the hob which can be used being 6 inches.

The work spindle runs in a large taper bushing, which is accurately fitted and lapped. The fit of the spindle in the bushing is adjusted by means of a worm which operates a nut to move the taper bushing in an axial direction. An independent adjustment is also provided for the end fit of this spindle. The substantial work holding surface at the top end of the spindle is arranged at a convenient height for loading and unloading.

The machine can be furnished with the hob in a fixed angular position for either spur or helical gears of a given pitch, or a hob spindle with a slight angular adjustment can be provided for gears of different pitches. The machine will handle gears with a maximum of 3 diametral pitch, 18-in. diameter and 14-in. face. Ten hob spindle speeds, ranging from 50 to 225 r.p.m., are provided, and the feeds range from 0.01 to 0.25 in. per revolution of blank.

Special change gears can be furnished to cut tooth numbers from 3 to 50 and, with slight alterations, gears with from 3 to 160 teeth can be cut. A range from 6 to 200 or more teeth can also be arranged for.

The single pulley can be belted directly to a lineshaft or a motor drive can be mounted on the rear of the machine. The floor space required is approximately 53x84 in., and the weight of the machine is 6,500 pounds.

Bement 58-In. Locomotive Rod Milling Machine

The heavy-duty locomotive rod milling machine shown in the accompanying illustrations was recently built by the Niles-Bement-Pond Co., 111 Broadway, New York, N. Y., at its Bement Works, Philadelphia, Pa. The machine has a distance between housings of 58 inches.

The driving side of the machine is shown in Fig. 1. The 75-hp. motor is geared to the cutter spindle through a massive mechanism which is made sufficiently strong to transmit the power from a 100-hp. motor, should cutters that could absorb this amount of power become available. Special attention has been given in the design to such features as smooth cutting action, suitable range of table feeds, convenience of manipulation and thorough lubrication.

The spindle is driven by a large manganese bronze wormwheel of coarse pitch, which engages a hardened steel worm equipped with a ball thrust. Both worm and wormwheel run in a bath of oil. The large

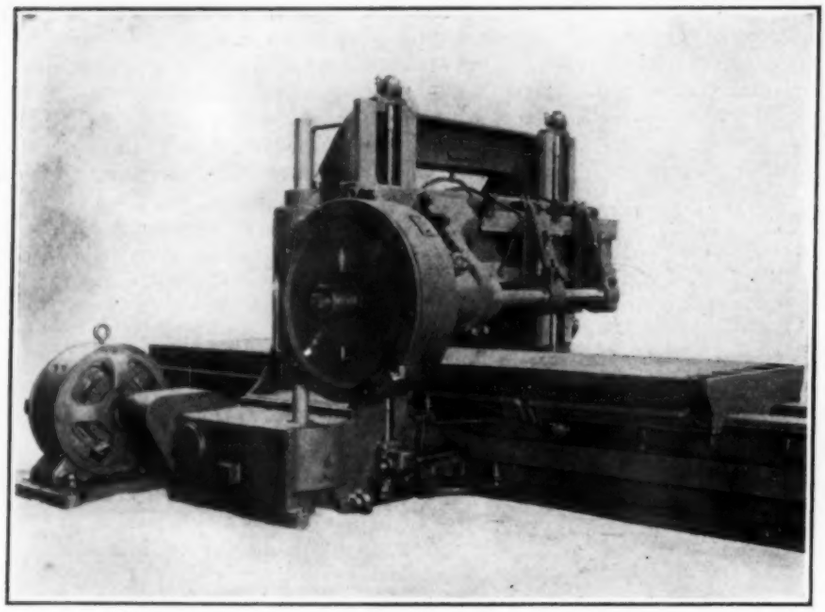


Fig. 1—Bement 58-In. Locomotive Rod Milling Machine

diameter of the wormwheel, together with the tangent type of gearing, gives the smoothness and steadiness of action so essential for eliminating chatter and preserving the edges of the cutter.

The drive shown in Fig. 1, which is for direct current, is very simple. A variable speed motor with the same range of speed as that required by the cutter arbor is used, so that the full speed range is obtained without the introduction of change gears.

The table has the usual power feeds and fast power traverse on the bed, driven by a separate motor, shown in Fig. 2. The power is transmitted by a bronze pinion running in a pocket of oil and engaging with a steel rack on the under side of the table. The cross-rail also has rapid power adjustment in both directions, as well as a power vertical feed for raising the cutter out of the work. The downward feed is manually operated, as a safeguard against breaking cutters when sinking them into the work.

Both the power feed and rapid adjustment are operated by this same motor which is so wired to the driving motor panel that it stops when the driving motor is shut off. The motor can also be used for rapid traverse of the table or rail when the driving motor is not in operation. The feed motor has a special control, so that it eases off its pulling power slightly when the cutter meets unusual resistance due to excess metal or hard spots.

The machine is equipped with a complete circulating and draining system for cutting fluid. The fluid flows to the cutters by gravity from a tank in the top cross-piece between the housings, draining from the table to a lower reservoir from which it is pumped back to the tank. When an alternating current or constant speed motor only is available, suitable change gearing is introduced.

The over-all width of the table is 54 in., the length of the table between end pans being 16 ft. A maximum distance of 32 in. is available between the table and the center of the arbor.

It is stated that one of these machines, installed in a large locomotive manufacturing plant, is able to withstand in all of its parts the heaviest possible cuts. The best cutters available are used and the machine is said to operate under these conditions without chatter or other troubles.

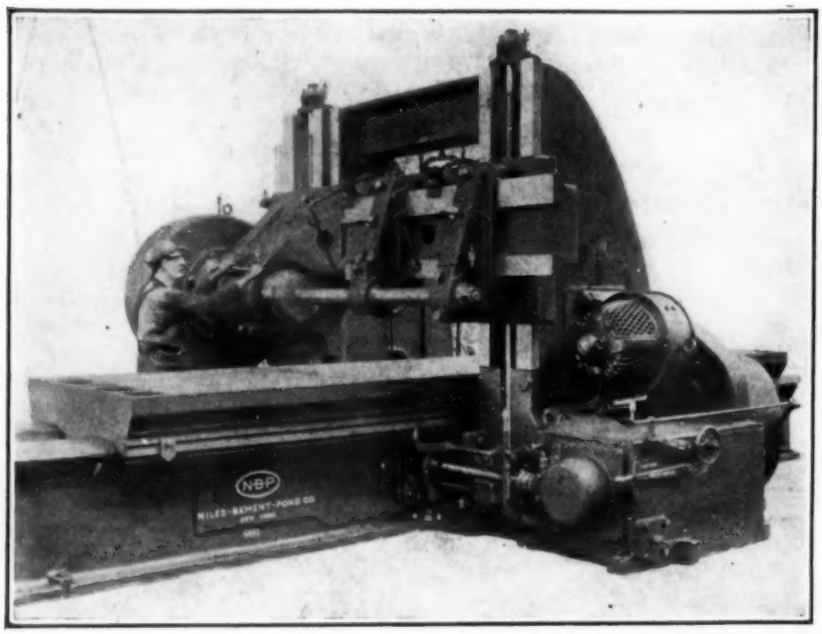


Fig. 2—Feeding mechanism side of Bement Milling Machine

Received Too Late for Publication

Descriptions of the following new equipment were received too late for this issue. Complete accounts will be published in this section in the near future.

Ryerson No. 5 Friction Saw. Joseph T. Ryerson & Son, Inc., Chicago, Ill.

Le Blond 17-In. Heavy Duty Production Lathe. The R. K. Le Blond Machine Tool Co., Cincinnati, Ohio.

Watson-Stillman Hydraulic Flanging Press. The Watson-Stillman Co., New York, N. Y.

Clark "Duat" Tructractor. Clark Tructractor Co., Buchanan, Mich.

"Metco" Electric Furnaces for Heat Treating. American Metallurgical Corp., Boston, Mass.

H. & G. Improved Dieheads. The Eastern Machine Screw Corp., New Haven, Conn.

Lindmark Tool Holder. Andrew B. Lindmark, Bridgeport, Conn.

Societe Genevoise Boring Attachment. The R. Y. Ferner Co., Washington, D. C.

Zoerman Adjustable Screw Plate. The Zoerman-Clark Manufacturing Co., Chicago, Ill.

Federal Dial Comparator. The Federal Products Corp., Providence, R. I.

"Quixsum" Adding Machine. Precision Adding Machine Co., New York, N. Y.

Stevens "Spintite" Wrenches. Stevens & Co., New York, N. Y.

News of the Week

Annual Meeting of S.A.E. Is Moved from New York to Detroit

Fokker Discusses Airplane's Future at Conference

The annual meeting of the Society of Automotive Engineers was held in Detroit this year, Jan. 22-25, at the General Motors' Building, instead of in New York as has been the custom, and was well attended. The opening session was devoted to the reports of the Standards Committee, each division being represented by the chairmen named: Agricultural Power Equipment, C. B. Rose; Axles and Wheels, C. C. Carlton; Engine, J. B. Fisher; Frames, W. A. McKinley; Lubricants, H. C. Mougey; Non-ferrous Metals, Zay Jeffries; Parts and Fittings, W. C. Keys; Passenger Car Body, A. J. Neerken; Storage Battery, I. M. Noble; Screw Threads, E. H. Ehrman; Tire and Rim, J. G. Vincent.

In the afternoon there were two simultaneous sessions, one on body engineering and the other on aeronautics. The attendance at the aeronautic session was particularly gratifying both as to numbers and the interest shown. The first aeronautic paper was entitled "Sand Cast Aluminum-Copper-Nickel-Magnesium Alloys," by A. J. Lyon and Samuel Daniels, giving the experience of the army engineers at McCook Field. The metal is known in this country as magnalite and has four parts copper, two parts nickel, one and one-half parts magnesium and the remainder aluminum. A sand casting gives from 25,000 to 28,000 lb. tensile strength and is from 70 to 80 Brinell hard. By heat treatment, heating to 975 deg. F. for 5 hr., and then quenching in boiling water it assumes, after aging, a Brinell hardness of 90 to 105 and a tensile strength of 45,000 lb. When castings are made in chills, the strength is from 5 to 10 per cent higher. The metal should be poured slowly through choked gates to eliminate dross from the castings. Piston and cylinder heads for air cooled motors have been successfully made by this method.

Motors for Aircraft

George J. Mead of the Wright Aeronautical Corp., presented a paper entitled, "Designing for Reliability," in which he traced the improvement in motors for aircraft since the development for war purposes. He showed that weight did not necessarily mean reliability as there were motors now of less weight than before, with a much longer life. Some of the present motors weigh less than 2 lb. per hp., and have stood up under continuous runs of from 300 to 572 hr. without overhauling.

He pointed out that the Liberty motor was now over 7 years old and that, while it had done good work, newer designs are now available where from 650 to 750 hp. can be secured for much longer periods than was then possible, the mean effective pressure now running up to 140 lb. per sq.in. Every pound saved in engine weight allows at least a corresponding reduction in the weight of the plane itself, which is a point well worth careful consideration.

Starr Truscott, who was to speak on "The Engineering Romance of the Shenandoah," was unable to be present, probably owing to his presence being required to assist in the repairs after her recent successful battle with the elements.

Fokker's Talk

A pleasant surprise was the appearance of Anthony G. Fokker, the well known Dutch builder of airplanes, who stated that the main reason for the delay in commercial aviation in this country was the lack of suitably equipped landing fields. He cited Holland as an example. Not being in the war she had no great landing field development as did the other countries. But the need of such fields was seen at once by Rotterdam, which provided a splendid airport. Amsterdam was much slower in seeing the necessity for such accommodations and as a result Rotterdam is now a great flying center for transcontinental routes and Mr. Fokker is moving his large plant from Amsterdam to Rotterdam. For over three years planes have been carrying passengers from Rotterdam to London, flying some 15,000,000 passenger miles, without an accident. Furthermore they have flown over 95 per cent of the time on schedule, some flights having been made in weather so bad that not a steamer left either port. He also spoke of the excellent work done by the U. S. Air Mail, with inadequate equipment and over a difficult country, its work having the admiration of all Europe.

Mr. Fokker cited several instances where regular airplane routes, flying only by daylight, saved much valuable time. From Berlin to Moscow takes four days by rail. But by using the train at night and a plane by day, the trip can be made in twenty-four hours. A similar case is from Paris to Northern African ports. He urged Detroit to provide several airports within easy access of the city, predicting that 1,000 airplanes would be just as much a necessity to the inhabitants of Detroit as the 200,000 automobiles it now uses.

Ralph Upson, the well known engineer in the lighter-than-air field, outlined the all-metal airship which he is now at work on, believing that the fabric covered ship is not a commercial proposition. He spoke of the Shenandoah's fuel consumption which, figured on a full load passenger carrying basis, was 0.3 cents per passenger mile from data obtained from its St. Louis flight. Comparing various passenger carrying methods he stated that the Leviathan carried 26,000 lb. dead weight per passenger, a pullman car 9,000 lb. and a dirigible 1,000 lb. The all metal airship permits the use of hydrogen gas which he considers much more desirable in every way except from the fire risk, and he does not feel that this is of sufficient danger to warrant the use of helium gas. According to his data the use of hydrogen gas will give the Shenandoah a cruising radius nearly double that which helium gas would give. He feels that hydrogen is almost a necessity for the North Pole flight.

In the evening Gen. C. L'H. Ruggles gave a most interesting address entitled, "The Automotive Industry and National Defense," pointing out the strides that had been made in coordinating the manufacturing facilities of the United States. Gen. J. W. Joyes showed some extremely interesting motion pictures of automotive development in the Ordnance Department, including new tanks, tractors of various kinds, amphibious motor craft and other vehicles which performed almost unbelievable stunts on uneven land and in mud and marshy ground.

Wednesday was devoted to brakes, body engineering, motor-truck transportation, and fuel and engine sessions at which many important features were discussed, four wheel brakes, carbureters and manifolds being much in evidence.

Production Sessions

At the production session on Thursday, A. A. Brown of the Chandler Motor Car Co., outlined its method under the title of "Flexibility in Handling Production Material." The system is an evolution in which the keynote has been flexibility and he emphasized the necessity for intelligence in the people responsible for running the system, stating that no system was better than the men handling it.

Instead of having a central stock room for raw material, they have material delivered at points nearest to the machinery units. All records are kept by the purchasing department, but the material is routed through the plant by the chief inspector who has wide discretion, to be exercised in keeping the different units going through in sufficient quantities. Hand trucking has been practically eliminated, special boxes and platforms being supplied for the electric driven lift trucks used. Conveyors are also used wherever possible.

The foremen keep no record of stock but each sees that he has enough raw material to keep his men busy. The system reduces the amount of stock going through to a minimum, reducing money tied up in inventory and enabling changes in design to be made at shorter intervals. As one of those discussing the paper put it, the system is of the "pull" type, each department keeping alert for sufficient material rather than having it pushed on them.

Thomas Nadin of the Rolls-Royce Co. gave suggestions to purchasers and users of machine tools in which he pointed out defects in the design of many bearings which makes lubrication difficult and repairs heavy. He spoke particularly of countershafts and minor bearings rather than spindle and major bearings. Trouble with the small bearings nevertheless ties up a machine at important moments.

Mr. Nadin also pointed out the lack of care in guarding the machines and operators from the cutting lubricant and the usually inadequate filter or strainer through which it is returned to the tank. He advocated a double tank, one-half of which should be used as a settling tank, and a strainer with an area of at least one sq.ft. The small strainers soon clog, men punch holes in them and then the dirt gets into the pumps and cut them out. Rubber hose connections should be replaced by ones of the flexible metallic type.

James N. Heald called attention to the growing use of motor driven machines which eliminated countershaft trouble and the many improvements which had been made both in lubrication of bearings and in handling cutting compound.

One member suggested that all machines should be ordered with the specification that they comply with the state laws regarding safety to operators. It was further urged that machine tool builders and others should work toward a uniform code of safety laws so as to avoid the necessity of guarding machines in a different manner for each state or section of the country.

"The Installation and Operation of a Gage Checking Department," was the subject of a most interesting paper by Joseph Lannen of the Paige-Detroit Motor Car Co. The system is based on the axiom that accurate work requires accurate gages which are checked frequently. All gages are in charge of the gage-checking department and must be returned at stated intervals for checking. A record is kept of each gage and if it is not returned for checking, it is sent for.

System of Checking All Gages

When there are several gages of one kind, they are numbered serially in addition to the name of the gage and its size being plainly marked on it. After a gage is checked the gaging surfaces are coated with Prussian blue. If it is one of a series of duplicate gages, it is assumed that this is not needed and it is kept in the gage department and need not be checked again until it is used. If, on the other hand, a gage which should be used, comes back with the blue still on it, an investigation is immediately made to see if the parts are correct.

The gage department checks all company micrometers regularly, using "Jo" blocks as a standard. Workmen's "mikes" are checked on request. Gear cutting hobs are checked in the same department. Scleroscopes are checked daily and repaired when necessary. Two men handle the work and look after something over 1,600 gages.

The production sessions were continued all day Friday at which the subjects up for discussion were, "process and equipment for fender and body enameling," by Gordon Lefebvre; 'Crankshaft Production Problems." by I. M. Carpenter; "Reducing Costs by Efficient Management," by T. B. Fordham; "Hot Swaging," by R. A. De Vlieg and "Permanent Mold Casting," by Daniel Meloche.

In the laboratory section of the building were three very interesting exhibits of grinding machines furnished by the American Grinding Machine Co., the Heald Machine Co., and the Norton Co. These were working exhibits, each being well supplied with representative machines for automotive work and attracted much interest. The exhibits were not as easy to find as they should have been and many missed them on that account.

Screw Thread Commission Makes Changes in Definitions

Important subjects discussed at Washington meeting

Additions to and revision of its progress report were discussed at length at a meeting of the National Screw Thread Commission at the Bureau of Standards, Washington, Jan. 15 and 16. A section on special threads of fine pitches and large diameters, such as used on hub and radiator caps, was added to the report.

A representative of the A. P. Smith Manufacturing Co., appeared before the Commission to urge an increase in the tolerance for fire hose threads. The Commission approved a change in the tolerance so that the maximum looseness was slightly increased. The minimum diameter of the nipple was decreased slightly and the maximum diameter of the coupling increased in about the same proportion. This change was approved so as to provide for the longer life of the manufacturers' gages. The proposed changes will tend to bring into closer agreement the screw thread report and the report of the American Engineering Standards Committee's sectional committee on screw threads. It also helps to tie in the definition with those used in the report of the A.E.S.C. sectional committee on plain limit gages.

The revisions now being made in the report will tend to clarify certain points and make it more convenient for use. Screw thread products, however, which would be approved under the former specifications will be approved under the revised specifications.

The replies to the questionnaire on stove bolts sent out by the American Screw Co., the Corbin Screw Corp., and the Reed and Prince Manufacturing Co., asking preferences as to stove bolt standards, were analyzed by the Commission. Ninety-one per cent of the replies favored following the standards proposed by the National Screw Thread Commission, rather than those being followed by Cleveland manufacturers of stove bolts.

Among the motions passed at the meeting was one that the definition for allowance shall be:

"Allowance: (neutral zone) An intentional difference in the dimensions of mating parts; or the minimum clearance space which is intended between mating parts. It represents the condition of the tightest permissible fit, or the largest internal member mated with the smallest external member. It is to provide for different classes of fit."

Example: One-half inch Class 1 loose fit.

Maximum pitch diameter of nut	= 0.4500
Minimum pitch diameter of screw	= .4478
Allowance	= .0022

Another motion was that the definition for tolerance shall be changed to:

"Tolerance: The amount of variation permitted in the size of a part."

Example: One-half inch screw, Class 1 loose fit:

Maximum pitch diameter	= 0.4478
Minimum pitch diameter	= .4404
Tolerance	= .0074

Interesting Meeting of Taylor Society

Richard A. Feiss was re-elected president of the Taylor Society at the meeting held Jan. 24, 25 and 26 at the Engineering Societies Building, New York City. The other officers were all re-elected as well and in addition Percy S. Brown of the Corona Typewriter Co., Groton, N. Y., was elected a vice-president and Miss Mary Van Kleeck of the Russell Sage Foundation and William B. Ricketts of Chicago, were elected to the board of directors.

On Thursday afternoon Joseph W. Roe, past president of the Society of Industrial Engineers, presided and a paper entitled, "A Critical Analysis of Scientific Management" was read by Henry H. Farquhar. A discussion led by Robert T. Kent, Philip F. Moen and Frank B. Gilbreth followed. Thursday evening Richard A. Feiss, president of the Taylor Society, presided. H. P. Kendall of Boston delivered an address on "Types of Management: Unsystemized, Systemized and Scientific" and the discussion following was led by Sanford E. Thompson, Nathaniel G. Burleigh and Percy S. Brown.

With Mr. Kent presiding, those attending the Friday morning session heard a paper by John H. Williams on "Scientific Management and General Administrative Control." H. S. Person, Newton C. Brainard and Keppele Hall led the discussion on this paper. After the buffet luncheon Stuart Cowan read a paper entitled "Scientific Management in Selling and Advertising" and the discussion was led by G. V. S. Carroll, Philip J. Reilley, Joseph Hayes and Charles F. Pietsch. Friday evening Mary Gilson read a paper entitled "Personal Work in Scientific Management." Discussions followed by Joseph H. Willits, Bernice M. Cannon, Philip W. Carter, Robert B. Wolf, George Soule and Mary Van Kleeck.

Two papers were read Saturday morning, the first being "Scientific Management in Federal, State and Municipal Business," by Morris L. Cooke, and the second being "Scientific Management in Other Countries than the United States," by Frank B. and Lillian M. Gilbreth. The discussions on these subjects were led by Henry M. Waite and William H. Allen.

Plan Expansions at Steel Mills

Three building projects of the United States Steel Corp., involving the expenditure of $15,000,000 were outlined recently by Judge E. H. Gary, chairman of the board of directors. These projects consits of a $6,000,000 construction program at the Homestead plant, a like amount at the Gary tube plant and $3.000,000 for by-product coke ovens at Gary.

In discussing the construction program of the corporation Judge Gary said: "We are all the time making extensions and improvements at one or another of our various plants. Some are more important than others. It is not a new departure to recommend expenditures that are large.

"At present we are contemplating rearrangement and improvement of some mills of Homestead Works at Pittsburgh and appropriated $6,000,000 on account of the same. How much the total will be we are not prepared to say now, and will not be for some time.

"We are also proposing to complete the Tube Plant at Gary, Ind., which has been in process of construction for over a year. We have, likewise, recommended $6,000,000 on account of this work.

"Also, we have recommended the construction of an additional unit of 140 by-product coke ovens at Gary to meet full requirements of a large number of blast furnaces at Gary and South Chicago, which have been in operation for some years. For these ovens we have appropriated over $3,000,000.

"These, of course, do not include all work being done or contemplated, but they are leading items."

Thorough Examination of Applicants

Medical examination to determine the fitness of the man for the job are now required of applicants for work at the American Radiator plants in Buffalo. In the American Radiator plants placement is as important a factor as rejection of men unfit for employment and good results have been achieved in the two or three months that the system has been operative. It is also expected that this system will tend to improve the company's accident experience in connection with compensation insurance which will tend to lower the insurance rates.

Dr. F. N. Furlong, medical director of the company, is in charge of the employment examinations. The examinations are perhaps more thorough than in the average shop that make this a requirement. Height and weight are taken and examination is made for hernia, eye and ear trouble, heart action and lungs, the latter only in doubtful cases. Flat feet, varicose veins and the proper working of the joints are also noted. The regular chart test is used for the eyes, but the charts are varied from time to time to prevent cheating by memorizing. The examination normally takes about four minutes.

Those in charge of the American Radiator examinations believe that they will become increasingly important from the standpoint of placement as time goes on. For example, the company no longer will place a man with only one eye in grinding or other rooms where there are eye hazards, for any disablement of the sight in such a case would mean total disability, which therefore makes the hazard considerably greater.

In a recent case it developed that a candidate for the night shake-out department had entirely too low a vision for this character of work. He was placed elsewhere. There are certain jobs where the employment of a tall man would increase the hazard and in other cases the opposite is true. All of these things are gradually being worked out by the company and taking a place in the book of standards which will hereafter regulate employment.

At the present time the American Radiator Co. is examining only new applicants but it is likely that a little later every employee in all of the plants of the company will be required to take the examination.

Plan Extensive Buying of Locomotives

Inquiries for new locomotives to cost more than $13,000,000 were reported in the railroad district of New York. This is the largest volume of inquiries that has been in the locomotive market for many months, it was stated. In almost every instance these inquiries were reported as a part of projects to increase the equipment and decreased the operating costs.

The largest single order was that of the New York Central R.R. which it was estimated would total 100 large locomotives and might run close to the $10,000,000 mark. Another large order that is actively pending is that of the Atlantic Coast Line, which is reported in the market for twenty-five new locomotives. The Maine Central R.R. has also asked for definite bids on eight new locomotives.

Official Auto Output Announced

The output of motor vehicles in the United States during 1923 was placed in a Commerce Department announcement at a total of 3,636,599 passenger automobiles and 376,257 trucks, as compared with 2,339,760 and 246,281, respectively, in 1922.

For December the returns showed manufacture of 275,260 passenger cars and 27,875 trucks.

The Ford Motor Co. made 2,200,682 automobiles, trucks and tractors in 1923—775,059 more than in any previous year, according to production figures for the year. Of the total 1,915,485 automobiles and trucks were made in this country and 175,474 in foreign plants, including Canada. To the total of these are added 101,898 tractors and 7,825 Lincoln cars.

Abrasive Company Meeting

The annual sales conference of the Abrasive Co., Philadelphia, Pa., was held at the company headquarters on Jan. 10, 11 and 12. Sales representatives from all parts of the country were present. Production and selling policies were carefully and thoroughly outlined for the coming year. A dinner was given to the visiting salesmen at the Manufacturers' Club.

Interesting Speakers at Safety Meeting

Excellent attendance and an interesting program were the features of the joint safety conference of the Engineering Section of the National Safety Council and the American Society of Safety Engineers, held Jan. 22, at the Engineering Societies Building, New York City. The conference was divided into two sessions and an informal dinner that was held at the Fifth Avenue Banquet Rooms, 200 Fifth Ave.

At the morning session, Ralph E. Prouty, supervising safety engineer of the Aetna Life Insurance Co., New York, acted as chairman, and the speakers were as follows:

David S. Beyer, vice-president, the Liberty Mutual Co., Boston, Mass.; George C. Agry, assistant industrial sales manager, the Lamson Co., Syracuse, N. Y.; and A. L. Lewis, president, the Lewis Shepard Co., Boston, Mass. A round table discussion on handling materials followed the speakers.

THE AFTERNOON SESSION

In the afternoon T. H. McKenney of the Illinois Steel Co., Chicago, Ill., presided as chairman, substituting for G. A. Orth, claims attorney for the American Car & Foundry Co., New York City, who was unable to attend. The first speaker at this session was D. H. Deyoe of the General Electric Co., Schenectady, N. Y. Electric welding and cutting and the various safety methods that have been applied to this operation were discussed. H. S. Smith of the Union Carbide & Carbon Corp., New York City, spoke on, "Safety in Gas Welding and Cutting." Charles Sheard of the Research Laboratories of the American Optical Co., Southbridge, Mass., gave an illustrated lecture on, "Glare, What It Is and What It Does."

The dinner, which was held at seven o'clock, was presided over by George T. Fonda, of the Columbia Salvage Corp. Several able speakers were heard.

India and China Buying More Machinery

Labor shortage in India has greatly stimulated the use of coal cutting machinery in the Indian coal mines, according to a report to the Department of Commerce from Trade Commissioner C. B. Spofford, Jr., Calcutta.

Most of the large collieries in the various fields are now equipped with electric power. Forty electrically-driven coal cutting machines were in operation in the Ranesgunge and Jherria fields, and during 1922 these machines cut a total area of 1,065,456 sq.ft. In addition, three machines operating on compressed air cut 190,890 sq.ft. in the Jherria field. One colliery has introduced a mechanical loading conveyor which operates by compressed air.

A movement is now on foot to increase the coal carrying capacity of the railways, and also increase the output of the mines.

The demand for woodworking machinery and equipment has increased considerably in Canton during the past two years, according to Vice Consul Howard Bucknell, Jr., Canton, China, and is credited to the increasing cost of labor which is forcing producers to use labor-saving devices.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Canada

In a special bulletin to its members, the Canadian Manufacturers' Association says: "The outlook of the machinery and machine tool manufacturers is a good index of the general state of business in Canada, and it is, therefore, gratifying to see so little pessimism among them. The industry is holding its own and looks with confidence towards the coming months."

The statement of the Canadian National Railways covering operations for the past year indicates a steady advancement in the volume of Canadian business. An increase of nearly twenty two million dollars or about ten per cent in the total operating revenues for the year fairly accurately represents the general industrial and trade improvement of the country.

According to reports from the principal industrial centers the first three weeks of the new year have netted the machinery and machine tool dealers a fairly satisfactory volume of business. Inventory is practically completed and buyers are entering the market for their immediate requirements. The automobile producers are quite busy, but production is not at maximum in all cases, because of the readjustment to operation in a larger plant in the case of one of the important companies.

The Canadian Pacific Railway has placed an order for 15 locomotives with the Montreal Locomotive Works, and orders for machine tools and other supplies have been placed with several local shops as the work is to be proceeded with immediately.

Detroit

To say that the Detroit district is optimistic is to put it mildly. And better still, this is not due to orders hoped for in the future, but to being actually busy at the present time. For while some automobile plants have not yet resumed a full production schedule, others are actually working nights to get a supply of cars for their dealers. And those that are not up to schedule are approaching it as fast as conditions will permit.

The production schedule seems to be full in most cases up to August, few going beyond that date but all feeling sure that the year's production will equal last year's if it does not exceed it.

The automobile activity is, of course, reflected in the demand for machine tools, Detroit being the Mecca for machine tool salesmen at the present time. The demand, fortunately, is not confined to orders for machinery needed for increased production but is largely for replacements, which will give more economical production. Changes in design have made some new machinery necessary. The tendency toward "little sixes," occasionally referred to as an "epidemic," is responsible for some of the demand for new machinery.

New machines are also being bought as "standby" or reserve equipment so that production cannot be held up by the breakdown of any one machine. This of itself, shows that the managers have faith in the demand for cars being maintained during 1924 at least.

There is another hopeful sign in the Detroit district. The railroads are buying machinery and buying it right. They have more money to spend than for years past and they are buying "quality" equipment well suited to the work to be done. A noticeable change in the method of buying is also reported. The really progressive roads have put the purchasing agent where he belongs—as a buyer of what the mechanical department specifies. These roads have shop supervisors or machine supervisors who decide on the best equipment for the various work. But before deciding they consult the shop superintendent, the foreman and even the men on the job, in their endeavor to get just the best machines for the work. As a result the railroad shops are getting a lot of good machine equipment.

Not since the war have the dealers in machinery and shop equipment generally been so busy or so optimistic for the continuance of a good, healthy business. While Detroit is perhaps unusually fortunate and not strictly typical of the country at large, the effects of automobile activity are reflected in all parts of the United States.

Ford's Activities

The Ford Motor Co. has just completed a cement mill at the River Rouge plant. This will utilize much of the slag from the blast furnaces and has a capacity of 1,000 bbl. a day. It is expected to start operations early in February. An interesting feature is that the Ford Motor Co. expects to use practically the entire output of this new cement mill in its own construction work. Not all of this will be used at the Rouge, although large buildings are now under construction, but the cement will be distributed to other building operations of the company at the many points where construction is under way.

Milwaukee

January volume of sales of metal-working equipment by Milwaukee dealers has disclosed itself as fairly satisfactory.

With a few unimportant exceptions, machine tool business is confined largely to replacements of wornout instruments or the desire of shop owners to supplant older designs of tools with later developments of greater efficiency and higher productive capacity. The West Milwaukee car and locomotive shops of the Chicago, Milwaukee & St. Paul Railway Co., long ago laid out a very sizable list of needs of new and additional machinery, but against this list purchases check but a small percentage of the total. The decided break in weather conditions at the beginning of the year has made its influence felt and the saving which grew out of the unusually mild fall and early winter is likely to be offset by the extreme operating conditions that have obtained since Jan. 1, and will at least serve to demand the use of the entire existing capacity of repair and service shops, and eventually may lead to broader equipment needs if only on a purely replacement basis.

Auto Industries Buying

The major share of business booked by local tool builders in January is credited to the automobile industry. In this respect January business falls considerably below that of the same month in 1923, and it is doubtful if 1924 sales will measure up to last year.

The tool trade looks for an increasing demand for equipment of all descriptions as the result of the tremendous development now going on in the radio field.

Manufacturers of contractors' equipment are working at capacity on old and new orders and appear to have an excellent year before them. Despite predictions, the wave of new construction has not spent its force, although some admit the peak has been passed.

New York

Machinery and machine tool buying was slightly improved in the New York market during the week as compared with the other weeks in January and the number of inquiries remained about the same which was unusually large for this season of the year. The inquiries form the basis for the machine tool dealers optimism, and there is every indication that buying will commence within the next week or two.

Railroad buying has improved and some of the general industrials in the Metropolitan section have been buying. Locomotive works have been in the market during the past week, with medium sized orders and the big electric companies are inquiring for tools with the probable date of purchase set as some time in March.

Used tools are in demand and dealers state that prices received are fairly good. No trouble has been experienced in obtaining desirable tools.

All railroads are reported as being in the market for freight cars and locomotives and this will mean orders from the shops making this equipment.

Reports from the steel mills would indicate greatly increased production and the final report for January will in all probability be most encouraging for the machinery and machine tool business.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

IF THE experiences of the war had not made business men phlegmatic many of them would now be having nervous prostration. For what a perplexing outlook they face! Lenin is dead—surely dead this time—and no one knows how Russia will react now that its hundred and seventy million people are released from his grip.

In England a labor ministry has taken office while the railroads are tied up by a strike, and the British Empire has become an anomaly in history—an aristocratic monarchy administered by a socialistic government whose cabinet includes several members of the nobility.

In France the popularity of Poincare is visibly waning and as in England the tendency seems to be toward what is today called radicalism though it may be regarded as conservatism tomorrow.

On this side of the Atlantic we are facing a presidential campaign in which business will be closely concerned. The conflict has already commenced in Congress, where the fight over tax reduction seems likely to result in a deadlock. From North and South Dakota, where more than fifty banks have failed in the last ninety days, there comes a plaintiff cry for help over the crisis caused by the failure of the wheat crop.

The situation is so serious that President Coolidge has dispatched three members of the Federal Reserve Board and the head of the War Finance Corporation to look into it, and has made it the subject of a special message to Congress.

On the South we are being rapidly drawn into a position in which we may be made sponsors for the Obregon government in Mexico and find ourselves obligated to pacify the country, while travelers returning from the Philippines say that the unrest there is greater than since the early days of our occupation.

But facing all this we have "business as usual" with steady markets that are in some cases higher, although it is generally agreed that there is a slight contraction in the volume of trade and that labor is not as fully employed as it was.

To particularize, corn and oats are higher. It is said that the farmers won't sell. Wheat is firmer, out of "sympathy" it is explained. Cotton is steadier at a slight advance. Here again the reason assigned is the farmers' obduracy in holding.

Wool is up in Australia and London as well as here. For this European inflation is blamed. Coffee is also somewhat higher on the decline in the milreis which is the result of further inflation in Brazil. Copper is back to 12¾ cents after having sold at 12¾. A better demand from abroad is said to be the cause of the rise.

What's Doing in Industry

Machinery and machine tool buying showed a slight improvement during the week and there was no abatement in the unusual number of inquiries that are being received by machine tool dealers in all parts of the country. The Eastern section of the country reports the best sales, with the West complaining about deferred purchasing. Several important expansions were announced during the week, the most notable being those of the United States Steel Corporation.

The electrical field has recovered from the after-holiday slump that was felt during the first two weeks of the new year and business is reported as booming in all sections, particularly in the Southern district of the United States. Expansions are also reported from all of the big electrical companies.

Encouragement is found in the condition of the non-ferrous metals market, where a price advance in all lines is reported. The demand for these metals is good and prospects for improvement are likely.

Industrial conditions are characterized as good, but not quite up to last January.

Iron and steel are improving. Oil is higher. A smaller production is the reason, and lumber has advanced on an active demand for spring delivery. Hides are somewhat dearer; so is leather, and even the dry goods market is becoming a little livelier as merchants find it necessary to replenish their very small stocks.

The stock market is likewise static, but resilient. Liberty Bonds are slowly advancing and most other securities have followed in their train, although certain oil stocks are lower because of the scandalous disclosures that have been made in Washington, and some automobile shares are weaker on seasonal predictions of "saturation" in the market for motor cars.

This contrast between the stolidity of business and the instability of political conditions is brought into relief because it may indicate that the leaven of gold inflation is at last beginning to work. Money grows easier day by day and it is pressing for employment.

In trying to camouflage our huge holdings of gold the Federal Reserve Board has advertised them, and the weekly statement of the Reserve System shows a reserve ratio of 80.4 per cent, with earning assets of only $938,000,000, out of total resources amounting to $4,936,000,000.

Foreign exchange is meantime "weakish" and while francs and sterling are not quite as low as they were, the European demand for dollars indicates that the westward drift of capital continues.

Briefly stated the fact seems to be that in most cases the upward tendency of prices reflects the indifference of sellers rather than the eagerness of buyers and that this indifference is due to the ease with which money can be borrowed and the absence of any financial pressure.

This is the first stage of inflation. The second stage will be reached when consumers come to understand that an exchange of money for goods is desirable because the value of the former is declining. Then there will be more eagerness to buy. The third stage will be a period of advancing wages. It is not yet here but there are a few intimations of its approach. The enginemen on the New York Central were awarded an advance of 5 per cent last week and it is reported that contractors have thrown the union wage scale into the discard in their eagerness to obtain mechanics.

It is of course possible that in this diagnosis the symptons may have been mistakenly correlated to gold inflation but if they are due to anything else then the case is an unusual one and the reason for its somewhat incongruous features is very obscured.

Meantime those who are wise and careful will watch the money market and study the bank statements closely from week to week. As long as it is possible to impound our preponderant gold supply its inflationary influence may be restrained, but an upward bound of prices will be almost certain if the dam gives way.

Personals

EDWIN C. HENN, vice-president and general superintendent of the National Acme Co., Cleveland, Ohio, has been elected president of the Cleveland Athletic Club.

F. K. HENDRICKSON, for many years with the Reed-Prentice Co., Worcester, Mass., as a mechanical engineer, is now with the Whitin Machine Co., Whitinsville, Mass.

FRANK T. CHASE has been elected a vice-president in charge of merchandising of the Zinke Co., manufacturer of automobile parts, Chicago.

DAVID H. LADD has been elected president and general manager of the Detroit Equipment Co., Detroit, Mich.

J. D. A. MORROW has been made vice-president, general manager and a director of the Joy Machine Co., Cincinnati, Ohio.

CHARLES L. NEWCOMB, chief engineer and general manager of the Deane plant of the Worthington Pump & Machinery Co. in Holyoke, Mass., and Mrs. Newcomb celebrated their golden wedding anniversary at their home in Holyoke, Jan. 19.

N. B. NORRIS, formerly at the New Orleans office of the Pawling & Harnischfeger Co., Milwaukee, is now district manager of the new Southern office recently opened at Memphis, Tenn.

F. B. LANGLEY is now with the Dow Pump & Diesel Engine Co., San Francisco, Calif.

JOHN CETRULE of the Triplex Machine Tool Co., New York City, has been appointed district sales manager in charge of the New York office by the B. C. Ames Co., Waltham, Mass.

LAURENCE V. BENET and JESSE MERRICK represented the American Society of Mechanical Engineers at the funeral of Alexandre Gustave Eiffel in France recently.

JOHN L. HARRINGTON has been appointed representative by President Hartness of the American Engineering Council to attend a conference of engineers, architects, contractors and cement manufacturers to advise the Bureau of Standards as to investigations that should be made by the Bureau that would be helpful to the manufacturers and users of Portland cement.

GEORGE I. ROCKWOOD, president and treasurer of the Rockwood Sprinkler Co., Worcester, Mass., and vice-president of the American Society of Mechanical Engineers, will endow a gold medal of the society to be awarded "in those rare cases when an individual has succeeded by the exercise of his genius and character in powerfully assisting the fortunes of our country or the general engineering progress of the world."

D. J. MURPHY, formerly at the New Orleans office of the Pawling & Harnischfeger Co., Milwaukee, is now in charge of the Texas district with headquarters at Dallas.

H. B. OSGOOD, for the past four years manager of the Giant Grip Manufacturing Co., Oshkosh, Wis., formerly known as the Challoner Co., has resigned, effective March 1.

JOHN H. CAUTLEY is now with the Perrot Brake Corp., South Bend, Ind., manufacturer of four-wheel braking systems. Mr. Cautley will be vice-president and general manager of the concern.

CHARLES W. TUBBY, formerly district manager in charge of sales in the St. Paul and the Seattle districts for the Worthington Pump & Machinery Co., has resigned. He will be engaged in similar work in the Seattle district after Feb. 1.

HUNTER MORRISON, formerly a director and sales manager of the Hill Clutch Co., Cleveland, Ohio, is now vice-president and general manager of the Metal Stamping & Manufacturing Co., Cleveland.

M. LUND has established his own business at Grand Rapids, Mich., under the name of the Lund Engineering Works. He will engage in designing and building special machinery.

N. A. MIDDLETOWN has become associated with the Ohio Body & Blower Co., Cleveland, Ohio.

W. J. DUGAN has assumed the duties of Southern sales manager for the Pawling & Harnischfeger Co., Milwaukee, with headquarters at Memphis, Tenn.

JOHN E. COBAUGH has been appointed Philadelphia representative for the H. J. Ness Manufacturing Co., New York City. His headquarters will be in the Stephen Girard Building.

FRANK A. SCOTT, president of the Cleveland Engineering Society, has been appointed chairman of the Committee on Local Arrangements for the Spring Meeting of the American Society of Mechanical Engineers to be held May 26, 27, 28 and 29, in Cleveland.

J. W. PETERSON of the Detroit Pressed Steel Co., Detroit, Mich., has been appointed works manager of the Locomobile Co., Bridgeport, Conn., to succeed vice-president DELMAR G. ROOS, who will devote his time to the engineering department, and serve in an advisory capacity the production and inspection departments.

WILLIAM R. WEBSTER, vice-president of the Bridgeport Brass Co., Bridgeport, Conn., has been elected president of the American Tube & Stamping Co., Bridgeport, Conn., to succeed EDMUND S. MAYO, recently resigned. Mr. Webster became a director of the company in 1916.

BRUCE Z. GOOD was made president of the Loomis Machine Co., Tiffin, Ohio. He succeeds GEORGE D. LOOMIS who died recently. Mr. Good formerly was secretary-treasurer of the company that manufacturers well drilling machinery.

CHARLES A. BUTLER, formerly with the Crosby Steam Gage & Valve Co., has opened offices in New York City, where he will represent the J. E. Lonergan Co. of Philadelphia, manufacturer of pop safety valves and pressure gages.

OTTO KLEIN, for many years connected with the Vulcan Manufacturing Co., Fond du Lac, Wis., iron works, has established himself in the welding, cutting and brazing business at 193 Military St., in the same city.

ANTHONY FLECK, formerly specializing in concrete-machinery conveying systems has joined the A. D. Granger Co., New York City, as sales engineer.

Business Items

The Persons-Arter Machine Co., Worcester, Mass., has acquired the rights, patents and equipment for the manufacture of the standard grinding machine formerly made by the Frazer Manufacturing Co., Westboro, Mass.

The Standard Gauge Steel Co., Beaver Falls, Pa., has discontinued its office at 611 Harrison Bldg., Philadelphia.

The Universal Bearing Bronze Co., Winsted, Conn., recently suffered a loss of $30,000 by fire. The main plant of the concern on Willow St. was destroyed.

The Standard Steel Spring Co., Madison, Wis., has been incorporated with $500,000 capital stock to engage in the manufacture of springs of all descriptions, for vehicles, beds, industrial and other purposes. The incorporators are: J. M. Schoonmaker, J. H. McMahon and R. J. Sucklen.

The Edgcomb Steel Co., Cambria and Eleventh Sts., Philadelphia, has been appointed exclusive agent for the Standard Gauge Steel Co., Beaver Falls, Pa., for the Philadelphia district.

Federal incorporation has been granted to the Galt Machine & Screw Co. Ltd. of Galt, Ontario, Canada, which is capitalized at $500,000 to carry on business as iron founders, mechanical engineers and manufacturers of machinery, screws, bolts, etc., and to deal in engines, tractors, and implements of all kinds. The principal incorporators are Richard W. Roelofson and Karl K. Jansen, manufacturers of Galt.

The Chicago & Northwestern Railroad Co. plans to start work at once on repairing and rebuilding its No. 2 ore dock at Ashland, Wis., which was badly damaged by fire on Jan. 17-18. The loss is estimated at $1,750,000, or nearly 75 per cent.

Obituaries

ALTON EMERSON STEVENS, inventor of the automatic telephone, selectophone and more than 700 allied contrivances upon which he obtained patents from the Government, died at his home in Providence, R. I. recently after a protracted illness. He was born in Addison, Me., in 1876 and was educated at an academy in Cherryfield, Me., and at the English High School in Providence, to which city he came at the age of sixteen.

HOMER B. BELFIELD, purchasing agent for the Billings & Spencer Co., Hartford, Conn. died recently. He had been with the company for the past 28 years.

JOSEPH D. ADAMS, president of J. D. Adams & Co., manufacturers of road building machinery, died Jan. 18, at his home, 2037 North Alabama St., Indianapolis, of pneumonia. He became ill about two weeks ago. Mr. Adams was the inventor of the Adams leaning wheel grader, the principal product of his company.

The French Economic Situation Today

Summary of business during last year—The depreciation of currency and its influence on industry—Expectations for the future

By Our Paris Correspondent

ACCORDING to reports of commercial attachés and the dicta of politicians and publicists, France is "looking up." In a very obvious way it is, but to "get up" is a process that is more difficult. The usual barometer indications of income and outgo are only partially reliable and not at all reliable when based on imports and exports alone.

The last quarter of 1923 may be said to have been much more favorable from most trade viewpoints than anything since recorded going back to before the war, but it is manifest that evaluations in francs are fictitious, though they may actually, in some instances, exceed those of 1913, as compared with those of bulk-tonnage.

With regard to the final outcome of the relations of France with Germany in general, and with the Ruhr in particular, there are many clear heads in France who do not hesitate to state that France is on the point of leaving the known for the unknown. It is probably just that as to fundamentals and, while French foreign trade sizes up big with respect to the value of exports, the same cannot always be said of tonnage on specific items.

The most notable exception to this estimate is that of automobiles. It should be considered, then, that all figures given in French statistics as to export values should be at least divided by three to even approximate a just estimate. Take the various standard items of trade with the United States as compared with what they were before the war in equivalents based upon the gold instead of the paper franc and it is not to be doubted that the observation is just.

Exporting and the Franc

The low valued franc (19.20 to the dollar in December and 20.50 on Jan. 4, 1924) has helped the export of iron and steel products to high exchange countries who seek to buy those commodities in France, but there is less disposition than ever to quote for future deliveries and that is one of the basic principles of foreign trade. Fabricated articles of iron and steel are in an even more precarious state, but the machine and small tool trade in general appears to be an exception, these articles benefiting from high dollar and sterling exchange and finding foreign markets where they never found them before. There are many machine tools, hand tools and accessories manufactured today in France which were not currently produced in the years before the war, then usually brought abroad for French consumption. In this respect much has changed, and especially to the detriment of America and England, and particularly in the past six months, though during this period and for six months before, dating from the French occupation of the Ruhr, Germany may be considered as having been practically out of it.

If transportation receipts are any indication the fact that those of French railways increased 5 per cent during the first six months of the year, and probably augmented this percentage for the last six months, should be encouraging, not only for the railways, but for general business. These indications are less favorably marked when it comes to overseas transportation from the fact that in general French exports are of small bulk.

Imports from the United States showed an increase of the value of 685,715,000 francs and exports to the United States an increase of 218,804,000 francs in 1923.

Exports to Great Britain during the same period increased by 1,615,788,000 francs and imports increased 1,280,216,000 francs. Incidentally a large bulk of the latter increase was to the account of British Coal.

Raw Materials

The major industries have made satisfactory progress towards supplying both home and export trade, but raw materials prices are still high and rising, and mechanical output not at all on a par with that which is commonly current in the metal trades of America, England and Germany, even of Italy.

The Ruhr has been a complicating element and still is. There remains to be solved the problem of the disposition of iron and steel products without a process of "dumping" which will not only affect French manufacturers, but might conceivably bring about hard feeling in America and England if they were shipped overseas at under-market valuation.

French imports of raw and semi-raw materials for industries for the full year increased in value over the figures of 1922 by some six billion francs; manufactured articles by two hundred and fifty million francs, a proportionate showing which is considered satisfactory.

Exports were respectively increased three billion francs in each of the two classes mentioned, a still more satisfactory showing. Decidedly the basis of franc values for manufactured articles exported is encouraging since these increased figures largely represent the wage bill of French workmen. It is worthy of remark also that both imports and exports were pretty evenly distributed through the entire twelve months, a still more encouraging sign, and one of the reasons why there are so few shut-downs in France.

According to a statement of M. Lucien Dior, the French Minister of Commerce, France with a deficiency in trade balances of 23 billion francs in 1921 closes the present year with a deficit of not more than a billion and a half, these figures being those which merely estimate the operations of the closing weeks, but not likely to be greatly changed when anything more than provisionary figures are available.

Labor is fully occupied and a notable increase is seen in the volume of foreign labor imported into France from beyond the frontiers, most of it in the heavy industries—mining, siderurgy and in such of the metal trades as can employ unskilled labor. This foreign labor is largely recruited from Italy, Poland and Spain, with a large proportion of Kabyles from the North African provinces under French control.

This immigration, some of it seasonable and much of it permanent, has often run, according to the official labor immigration bureaus at the frontiers, as high as four thousand a week. Virtually all have come in on what may be called "labor passport permits," the government reserving the right to repatriate their bearers the moment that it is found that they are cutting in on the French laborer, should a lull in affairs supervene. French industry as a whole is over supplied with labor, but there appears to be a shortage in that of agriculture, due to a considerable extent by the losses of the war and also by the desertion of the countryside by the young farm laborer for the attraction and the higher wages and more ample freedom of the industries of the cities and towns.

Failing to receive an influx of farm labor from some source, the day is bound to come, even in France, when there will be a big development in the use of farm tools and machinery and such ordinary domestic tools and machinery as are in common use in America. This in its wake will bring about the perforced establishment of new manufacturing industries to produce them for it is unlikely that French tariffs will be revised downward and the exchange problem is one still so vaguely indefinite that no one can prognostigate with surety what the future is to bring forth. If new establishments are not to come something more will have to be carried out than the timid developments which many French manufacturers in these lines have undertaken up to today. Again there imposes itself the possibility and desirability of the extension of Franco-American industrial affiliations as hitherto suggested.

Announce Leipzig Fair Representatives

Announcements have been received in this country of the forthcoming Leipzig Fair, to be held in Leipzig, Germany, March 2 to 8. The many advantages of representation at this international event are outlined in a circular that has been sent out by the Messamt fur die Mustermessen in Leipzig and it is stated in the text that the honorary representatives of the Messamt in this country are the Atlantic Forwarding Co., 45 Pearl St., New York City; William A. Reupke, 100 North LaSalle St., Chicago, Ill., and Karl Offer, 465 California St., San Francisco, Calif.

Employment Bureau for Engineers

The professional engineer, whether he be civil, mining, mechanical, electrical or one of the other many varieties thereof, is frequently called upon to face the problem of placement of his services. Successfully to do this means to find the hole of precise geometrical proportions in which to fit his particularly shaped peg of engineering experience. Conversely, the engineer requiring competent engineering assistants is frequently at his wits end to locate someone with the needed training and experience.

The National Engineering Societies have for many years maintained "engineering employment clearing houses," but because of lack of sufficient funds these have not attained the status of a national service. Within the past few months, the employment service operated under the joint supervision of these national societies has inaugurated a policy calculated to insure the needed funds to provide a truly national service, with offices in leading cities throughout the country. Under this policy the societies continue their financial support and this is supplemented by contributions from those deriving benefit from this enterprise as no profit to anyone is to be taken, simply a self-supporting service. Contributions if on a basis of but twenty-five per cent of the fees which must be necessarily exacted by a commercial agency will make possible the realization of a national service.

FITTING MEN IN JOBS

With the new plan fully developed representatives of the employment service will visit those with positions available to get first-hand information as to the requirements of the job.

Over 55,000 engineers including the most prominent of the profession are members of the societies conducting the service, thereby ensuring employers a selection from engineers of known antecedents and whose records have been closely scrutinized. Thus automatically providing employers with facilities of unique extent.

Engineers seeking opportunities may arrange to obtain weekly by first class mail the current list of openings. Their availability is also announced in the respective publications of the Engineering Societies.

Employers of engineers and those seeking competent men for their executive staff will find this service of increasing value.

Canadian Auto Exports Increase

Accordng to a statement just issued by the Dominion Bureau of Statistics there was an increase of more than eleven million dollars in the value of automobiles exported from Canada to all countries during the year just closed. The total shipment of freight and passenger cars during the twelve months was 69,920 valued at $33,828,690 as compared with 37,958 valued at $22,154,093 in 1922. Exports of passenger cars totaled 57,481 valued at $29,235,031, being a betterment of 22,087 cars and $8,265,457 in value, while trucks shipped during the same period numbered 12,439 valued at $4,503,659, being an increase in number of 9,875 and of $3,409,140 in value.

Automobile parts exported during the twelve month period increased in value by $1,604,279, while there was a betterment of $58,643 in the value of parts shipped during the month of December, as compared with the same month in 1922. British South Africa, Australia, New Zealand and Brazil were the best customers.

Good Earnings Shown by Bethlehem Steel

The Bethlehem Steel Corp. did a gross business of $275,213,000 in 1923 against $131,866,000 in 1922, according to a preliminary statement issued by Eugene G. Grace, president of the company, following a meeting of the directors, at which the regular dividends on the common and preferred stocks were declared. Total net earnings for the year amounted to $37,373,228, against $19,793,712 and the net income available for dividends totaled $14,374,152, against $4,605,330 in 1922. After payment of preferred dividends for the company, the company reported a balance of $10,055,898 available for the common, which was equal to $6.46 a share. After payment of all dividends, there was reported a surplus of $2,288,824, against a deficit of $2,332,685, after dividends, in 1922.

Gary Will Be Chairman at Joint Dinner

Judge Elbert H. Gary, chairman of the board of the United States Steel Corp., will preside at the joint dinner of the New York Sections of the Army Ordnance Association, American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the Society of Automotive Engineers, and the American Institute of Electrical Engineers, which will be held on Tuesday evening, Feb. 5, at the Hotel Commodore.

The addresses following the dinner will be devoted to the subject of Industrial Preparedness as Insurance Against War, and the speakers will include Judge Gary, Assistant Secretary of War Dwight F. Davis, and Col. James L. Walsh.

Accident Prevention Plan Urged

Practical operation of a nation-wide plan designed to reduce accidents to workers in all lines of American industry is announced by the National Industrial Conference Board.

At the same time the board called attention to estimates by Government experts, showing that mishaps to workers this year will probably cause more than 21,000 deaths and a money loss of more than a billion dollars.

The new plan, which is to be adopted by manufacturing associations and other private and official agencies, resulted from the revelation that deaths and mishaps to workers have shown no appreciable decrease during the past few years, while the money loss through idleness, medical treatment and insurance has risen from a quarter of a billion dollars annually to an estimated total for the present year of more than a billion dollars. The board gave out a detailed tabulation of estimates showing the economic losses suffered through accidents in industry.

Catalogs Wanted

Makers of automatic weighing and boxing equipment for the packing of wire nails are requested to send full data with their quotations, blue prints, photographs, net and gross weights, cubic measurements and prices to the American Machinery Corp., Plaza de Casovas 4, Madrid, Spain.

A study is now being made by a special committee of the Special Libraries Association of the United States, pertaining to trade catalogs, and information is desired as to what firms in this country keep an historical collection of trade catalogs. Information regarding this subject would be gratefully received by Lewis A. Armistead, Librarian, Boston Elevated Railway, 31 St. James Ave., Room 711, Boston, Mass.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Sawmill machinery, Puerto Leguia, Peru. Purchase. Reference No. 8921.

Portable and stationary sawmill machinery. Vancouver, Canada. Agency. Reference No. 8925.

Woodworking machinery and water-pumping machinery. Santo Domingo, Dominican Republic. Agency. Reference No. 8906.

Small tools. Rotterdam, Netherlands. Agency. Reference No. 8872.

Forthcoming Meetings

American Gear Manufacturers Association. Spring Meeting. April 28, 29 and 30, 1924. Lafayette Hotel, Buffalo, N. Y. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

Society of Industrial Engineers. Eleventh annual convention. Buffalo, N. Y. April 30, May 1 and 2. Headquarters, 608 S. Dearborn St., Chicago, George C. Dent, executive secretary.

American Society of Mechanical Engineers. Spring meeting. Cleveland, Ohio. May 19, 20, 21 and 22. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association. Triple convention, May 19, 20 and 21, 1924, Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The General Committee of Division V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

The Lyons Fair. Lyons, France. March 3 to 17, 1924. Information furnished by Emile Garden, 50 Church St., New York City.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4,600 Prospect Ave., Cleveland, Ohio.

New and Enlarged Shops

Machine Tools Wanted

Ind., Evansville—Wilson Mfg. Co., 1519 East Nevada St.—2 spindle horizontal boring machine.

Ind., Gwynneville—J. Ham—drill press for blacksmith shop.

Ind., Laporte—Motor Oil Garage—machinery and equipment for proposed $60,000 garage and service station, to replace fire loss.

Ind., Milroy—G. Carr—lathe, drill press, belting, hangers, bearings and shafting.

Kan., Cherryvale—W. B. Finley—lathes, grinder, keyseater, shafting and hangers for machine shop.

Mass., New Bedford—City, N. Ricard, 220 Municipal Bldg., Chn. Comn.—equipment for proposed machine shop for manual training in school.

Mass., Worcester—H. H. Hazelton, 41 Chatham St.—equipment for proposed $40,000 garage at Worcester.

Mich., Detroit—Detroit De Luxe Co., 3408 Lincoln Ave.—cylinder grinder.

N. Y., Cassadaga—Motor Mfg. Co.—press, 30 to 36 in. flywheel.

O., Akron—Akron Gear & Eng. Co., 42 East South St.—gear cutting machines.

O., Akron—Buerger Iron Co., M. Miller, Purch. Agt.—lathe and shaper.

O., Akron—Edds Welding Shop, 54 East Cedar St.—motor driven grinder.

O., Akron—T. P. Howland—858 High St. (blacksmith shop)—motor driven drill press and blower.

O., Akron—Romig Bros., 884 High St., P. Romig, Purch. Agt.—drill press, cylinder reboring machine, motor driven small grinder and air compressor.

O., Akron—Summit Auto Garage Co., 704 South High St., A. Motz, Purch. Agt.—drill press, air compressor, complete tire repair equipment, small garage tools and machinery.

O., Chagrin Falls—Ober Mfg. Co. (machinery and castings)—lathes.

O., Cleveland—J. Kofran, 7724 Lexington Ave.—drill press, grinder, air compressor and other equipment for garage and repair shop.

O., Columbus—Blue Ribbon Automobile Co., 277 North 20th St., T. M. Byers, Service Mgr.—drill press, grinder and air compressor.

O., Hamilton—Hamilton Sheet Metal Co.—sheet metal working machinery and equipment, including bending machine, riveter, etc.

O., Lakewood—Bailey Buick Co., Detroit Ave.—cylinder reboring machine.

O., Springfield—Wickham Piano Plate Co., 1817 Sheridan St. (manufacturer of metal cast plates), J. C. Wickham, Pres.—boring and drilling machine, moulds, forms, transmission and conveying machinery for new foundry.

O., Toledo—Ohio-Paige Auto Co., 310-18 13th St.—10 in. lathe, welding outfit, presses and small tools for garage.

Pa., Danville—Pennsylvania Brake Beam Co.—vertical shear, capacity 1¼ in. round or square bars, also one K. & R. No. 1 roll angle straightener.

Pa., Erie—Erie Brass & Copper Co., 18th St. and Washington Ave., W. M. Spencer, Pres.—lathes, press and miscellaneous automatic machines, to replace fire loss.

Tenn., Chattanooga—Citizens Automobile Co., 7th and Broad Sts.—machinery, tools and equipment for proposed $40,000 garage, repair shop and service station.

Tex., Dekalb—Crump Motor Co.—electric valve grinder, 110 volt.

Wis., Lake Geneva—Lake Geneva Auto Sales Co., A. G. Laurie, Purch. Agt.—drill press and bench grinder.

Wis., Milwaukee—R. W. Leach, 137 8th St.—tool room lathe, air compressor and small tools.

Que., Montreal—N. Weinstein, 982 St. Catherine St., W.—lathe, drill press and grinder for garage

Machinery Wanted

Ala., Albany—Decatur Cornice & Roofing Co., Inc.—one 3 motor overhead 5 or 10 ton crane, 70 ft. span; friction saw; four electric hoists, 3 ton capacity, plain trolleys; rotary planer, 30 in. head; rivet forges.

D. C., Wash.—Bureau of Yards & Docks, Navy Dept.—receiving bids until Feb. 13 for electrical furnaces and converting equipment for Bellevue.

Ind., Angola—Standard Body Co. (manufacturer of automobile bodies and equipment)—woodworking machinery and equipment, including transmission and conveying machinery, for proposed $200,000 plant.

Ind., Evansville—Graham Truck Co., Stringtown Rd.—machinery and equipment, including transmission and conveying machinery, for proposed $100,000 factory.

Ind., Fort Wayne—Genl. Electric Co., 1703 Bway.—bending machine to bend cold 4½ in. angle iron to perfect circle.

Ind., Indianapolis—Real Silk Hosiery Mills, Inc., 624 North Noble St.—knitting machines and equipment for new factory.

Ind., Metamora—D. M. Gordon—lathe, rip saw and cutting off machine for woodworking shop.

Ind., Mishawaka—Mishawaka Monument Wks., East 1st St., D. A. Van De Walle, Proprietor—cutting, polishing and grinding machines for proposed $50,000 factory.

Ind., Muncie—Union Equipment Outfit Co.—machinery and equipment for proposed $50,000 factory for the manufacture of overalls, etc.

Ky., Hodgenville—R. M. Mumford—machinery and equipment for newspaper plant at Morganfield.

Mass., Boston—Natl. Can Co., 36 North Washington St.—machinery for proposed $150,000 factory at Dorchester.

Mich., Calumet—Calumet & Hecla Co.—crushing machinery for ore.

Mich., Muskegon—Clover Fdry. Co., 11th and Clay Sts.—foundry equipment, including molds, press, welder, etc.

N. Y., Auburn—Henry & Allen Co., Wadsworth St. (forge and hammer shops)—power hammers, welders, forging and forming machines, shafting, hangers and pulleys.

N. Y., Binghamton—Titchener Iron Wks., Frederick St. (iron, wire and grating), R. Z. Spaulding, Pres.—$10,000 worth of machinery and tools for proposed plant.

N. Y., Buffalo—Comn. of Parks and Public Bldgs., City and County Hall—receiving bids until Feb. 5 for furnishing and installing complete laundry and bakery machinery and equipment for Perrysburg Hospital.

N. Y., Buffalo—Iroquois Door Co., 629 Exchange St.—complete machinery and equipment, including shapers, planers and stickers, to replace fire loss.

N. Y., Buffalo—E. Wilson, 5 Park Pl.—fancy blower or shaper.

N. Y., Corning—T. G. Hawkes & Co. (manufacturer of cut glass)—complete machinery and equipment to replace fire loss.

N. Y., Fort Plain—F. A. Raven Co., Yerdon Bldg. (manufacturer of radio parts)—buffing and polishing machinery, automatic screw machine similar to Brown & Sharpe No. 00 and small bench grinders for new factory.

O., Akron—Akron Cabinet Wks., 570 South High St., M. Robison, Purch. Agt.—swing cutoff saw and shaper.

O., Canton—Boyer Co., 500 Market Ave., N.—$75,000 worth of presses and equipment for printing plant, to replace fire loss.

O., Cincinnati—Cleveland, Cincinnati, Chicago & St. Louis Ry., 511 West 3rd St., W. J. Hiner, Purch. Agt.—$65,000 worth of mechanical equipment for round house.

O., Elyria—Amer. Crucible Products Co.—core making machinery.

O., Fremont—J. B. Smith, Hotel Fremont—saws, planers, conveying machinery, etc., for development of large Canadian timber tracts.

O., Martins Ferry—Scott Lumber Co., H. S. Scott, Mgr.—equipment for proposed 70 x 170 ft. planing mill, to replace fire loss.

Pa., Erie—M. Strohmeyer, 641 West 18th St.—wood turning lathes, shaper and cut-off saw.

Tenn., Nashville—Tennessee Enameling Co., Charl Park, M. H. Wright, Purch. Agt.—about $25,000 worth of machinery, including punches, shears, transmission apparatus, furnaces, etc.

Tex., Hillsboro — W. V. Blasingame (woodworker)—sawmill, sanders, belting, hangers and bearings.

Wis., Alma—Natl. Soil Conservation Co., T. C. Beckmire, Purch. Agt.—sheet metal working machinery for the manufacture of metal culverts, etc.

Wis., Fort Atkinson—Knoepfel Bros.—motor driven air compressor, gasoline storage tanks and pumps.

Wis., Madison—G. Ripp & Son Co., 20 South Bassett St.—47 in. sander with 3 drums.

Wis., Milwaukee—Turner Simplicity Co., c/o G. C. Kuhlthau, Wells Bldg. (manufacturer of specialties)—belting, shafting and hangers.

Wis., New London—Krause Bros. (produce)—refrigeration machinery, motor driven.

Wis., Ojibwa—Co-operative Cheese Factory, c/o G. Squires and A. Kraft—cheese making machinery and vats for proposed $40,000 factory.

Wis., Prairie du Chien—J. T. Wall—air compressor, emery wheel, stand, gasoline storage tank and pump.

Alta., Edmonton—Reliance Oils of Canada, Ltd.—producing, storing, distributing and manufacturing equipment for petroleum and carbon oils.

Ont., Port Arthur—Nipigon Corp., Ltd., C. W. G. Gibson, 80 Homewood Ave., Hamilton, Purch. Agt.—machinery for pulp and paper mill.

Ont., Tavistock—Tavistock Milling Co.—complete equipment for proposed $90,000 flour mill.

Sask., Regina—Panama Pacific Grain Terminals, Ltd., J. H. Newson, Lumsden, Dir.—flour mill equipment.

Metal Working Shops

Calif., Emeryville—The Westinghouse Electric Co., 62nd and Powell Sts., awarded the contract for the construction of a 3 story factory. Estimated cost $300,000. Noted Jan. 3.

Calif., Los Angeles—The Los Angeles Welding & Mfg. Co., 1146 South Los Angeles St., awarded the contract for the construction of a 1 story, 50 x 110 ft. shop.

Calif., Los Angeles—F. H. Randall, 1132 North Vermont St., awarded the contract for the construction of a 1 story, 50 x 150 ft. garage on Vermont Ave.

Calif., Los Angeles—The Republic Brass & Mfg. Co., 1931 Violet St., awarded the contract for the construction of a 1 and 2 story factory to contain 69,000 sq.ft. of floor space, on 27th St.

Calif., Los Angeles—The Wilshire Garage Corp. awarded the contract for the construction of a 4 story, 150 x 150 ft. garage on 6th St. and Kenmore Ave. Estimated cost $280,000.

Calif., Oakland—G. T. Banks, 77 Sunnyside Dr., San Leandro (Branch of Oakland), awarded the contract for the construction of a 1 story garage on East 14th St. and 74th Ave., here. Estimated cost $42,000.

Calif., Oakland—The East Bay Water Co., 512 16th St., will build a 1 and 2 story garage, etc., on 21st and Adeline Sts. Estimated cost $48,750.

Calif., Pasadena—C. R. Luton & Co., Western Mutual Bldg., Los Angeles, awarded the contract for the construction of a 1 story, 65 x 115 ft. garage on West Colorado St., here.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Basic pig iron showing increased demand, owing to higher scrap prices. Volume of steel buying slowly increasing. Steel bars continue at the $2.40 base, with shapes and plates at $2.50 per 100 lb., Pittsburgh. Some shading of prices, however, is reported in structurals; as low as $2.35 per 100 lb. having been quoted on exceptional tonnages. Tin plate business active; mills operating at 95 per cent of capacity.

Advances—Copper tending upward; electrolytic, advanced ½c. per lb. in week. Antimony market strong; prices up. Aluminum also firmer.

Declines—Lead lower; dropped ½c. per lb. since last week. Demand for lead in paint industry trifle slower; increase, however, noted in volume of requirements for electrical manufacturing. Zinc market quiet; price down 17½c. per 100 lb. in New York warehouses, during week.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	22@23
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	3.00	4.34	3.75	4.00
No. 12	3.10	4.39	3.80	4.05
No. 14	3.20	4.44	3.85	4.10
No. 16	3.40	4.54	3.95	4.20
Black				
Nos. 17 and 21	3.70	4.55	4.45	4.70
Nos. 22 and 24	3.75	4.60	4.50	4.70
Nos. 25 and 26	3.80	4.65	4.55	4.75
No. 28	3.85	4.75	4.65	4.85
Galvanized				
Nos. 10 and 11	4.00	4.80	4.70	4.85
Nos. 12 and 14	4.10	4.90	4.80	4.95
Nos. 17 and 21	4.40	5.20	5.10	5.24
Nos. 22 and 24	4.55	5.35	5.25	5.40
No. 26	4.70	5.45	5.50	5.55
No. 28	5.00	5.75	5.80	5.85

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 34% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ½-in. to 1-in., O.D., weighing 0,17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
½	$0.09	50%	⅞	$0.16	35%
⅝	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	8.35
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	3.90	4.30
Cold drawn flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.30
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.54	3.36	3.20
Tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.50
Tin, 5-ton lots, New York			50.50
Lead (up to carlots), St. Louis	8.15	New York	8.37½
Zinc (up to carlots), St. Louis	6.50	New York	6.95

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	26.20	27.00	28.50
Antimony (Chinese), ton spot	11.50	11.50	10.25
Copper sheets, base	20.50	20.75	23.00
Copper wire, base	16.00	18.50	16.25
Copper bars, base	19.50	22.00	19.50
Copper tubing, base	22.50	26.75	23.00
Brass sheets, base	17.25	21.50	18.75
Brass tubing, base	21.50	26.50	20.50
Brass rods, base	15.00	17.50	15.75
Brass wire, base	17.75	21.50	....
Zinc sheets (casks)	10.50	10.45	....
Solder (½ and ½), (case lots)	34.75	31.75	30.00
Babbitt metal (83% tin)	52.00	61.00	48@52
Babbitt metal (35% tin)	25.00	20.50	22@25
Nickel (ingot and shot)	29.00	....	....
Nickel (electrolytic)	32.00	....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00

Shop Materials and Supplies

METALS—Continued

Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.37½	10.75	11.50
Copper, heavy, and wire	9.87½	10.25	10.75
Copper, light, and bottoms	7.87½	8.50	9.75
Lead, heavy	5.75	6.50	6.00
Lead, tea	3.87½	4.00	5.00
Brass, heavy, yellow	5.25	.. ..	7.25
Brass, heavy, red	7.00	9.25	9.00
Brass, light	4.50	4.75	6.25
No. 1 yellow brass turnings	5.00	5.75	6.75
Zinc	3.75	2.75	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$25.10	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.40	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.0
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.14@0.21	$0.20	$0.14
Cotton waste, colored, per lb.	.09@.12½	.17	.10½
Wiping cloths, 13¼x13¼, per lb	10.50	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb.	11.00	52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.95	1.00	.94
Lard cutting oil, 25% lard, per gal.	.55	.50	.67½
Lard oil, pure, per gal, 2 to 5 bbl. lots	1.03	1.01	.97
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber and duck:			
First grade	50–10–5%	50–10%	40–10%
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton		3.75@4.00
Coke, prompt foundry, Connellsville	per net ton		5.00@6.50
White lead, dry or in oil	100 lb. kegs		New York, 14.25
Red lead, dry	100 lb. kegs		New York, 14.25
Red lead, in oil	100 lb. kegs		New York, 15.75

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting	per lb.	0.044	0.044	0.039
Brass rods	per lb	0.15	0.155	0.17
Solder (½ and ½)	per lb.	0.3475	0.3375	0.29
Cotton waste	per lb.	.14@.21	.11@.14	0.11½
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.55	0.55	0.50
Machine oil	per gal.	0.29	0.29	0.33
Belting, leather, medium	off list	40–2½%	30–10%	30–10%
Machine bolts up to 1x30 in.	off list	45%	45%	40%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50–5%
1½ and 1¼x3 in. up to 12 in	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	30%	$3.50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65–5%
Lag screws, coach screws	45%	.....	60–5%
Square and hex. head cap screws	60%	70%	70–10%
Carriage bolts, up to 1 in.x30 in.	35%	50%	50–5%
Bolt ends, with hot pressed nuts	45%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, 5/16 and smaller	65%	.....	.....
Semi-finished nuts, ⅜ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ⅛ in., per 100 lb. (net)	$6.50	$4.00	$4.00
Washers, cast iron, ⅜ in., per 100 lb. (net)	5.50	4.00	4.00
Washers, round plate, per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.50	3.50
Rivets:			
Rivets, 7/16 in. dia. and smaller	50%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.60	$3.75
Cone heads, ditto (net)	5.20	3.80	3.85
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.35	.....	0.15
½ in. diameter *EXTRA*	0.75	.....	0.50
1 in. long, and shorter *EXTRA*	0.75	.....	0.50
Longer than 5 in. *EXTRA*	0.50	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.45	.....	$3.70 base

Calif., Roseville—The Pacific Fruit Express Co., 65 Market St., San Francisco, plans to build car building and repair shops on a 250 acre site, here.

Calif., Sacramento — J. Rasmussen awarded the contract for the construction of a 2 story garage on I St. between 7th and 8th Sts. Estimated cost $47,240.

Calif., San Francisco—B. Getz, Chronicle Bldg., will build a 1 story garage on Geary St. Estimated cost $42,000.

Conn., Hartford—The Bd. of Water Comrs., 1026 Main St., is having plans prepared for the construction of a 3 story, 150 x 200 ft. repair shop and warehouse on Homestead Ave. Estimated cost $150,000. Whiton & McMahon, 36 Pearl St., Archts.

Conn., Torrington—The Progressive Mfg. Co., 52 Norwood St., manufacturer of machine screws and rivets, awarded the contract for the construction of a 2 story, 165 x 180 ft. factory. Estimated cost $40,000.

Fla., Jacksonville—The Ford Motor Co., Highland Park (Detroit P. O.), awarded the contract for the construction of a 1 story, 200 x 500 ft. assembly plant on 8th St. and St. Johns River, here. Noted Dec. 20.

Ill., Abingdon—The Amer. Sanitary Mfg. Co. is having preliminary plans prepared for the construction of a 1 story, 90 x 200 ft. addition to its factory for the manufacture of brass plumbing supplies. Lockwood, Greene & Co., 38 South Dearborn St., Chicago, Archts.

Ill., Chicago—M. O. Nathan, Archt., 123 West Madison St., is receiving bids for the construction of a 1 story, 72 x 100 ft. garage at 54-62 East 31st St. for E. Hudson, c/o Architect. Estimated cost $40,000.

Ill., Chicago—M. O. Nathan, Archt., 123 West Madison St., is receiving bids for the construction of a 1 story, 100 x 175 ft. garage for A. Randall, 3135 West Harrison St. Estimated cost $50,000.

Ill., Peoria—The Cutler & Proctor Stove Co., 201 North Water St., plans to rebuild its 4 story, 150 x 200 ft. plant which was recently destroyed by fire. Estimated cost $150,000.

Ind., Evansville — Graham Truck Co., Stringtown Rd., awarded the contract for the construction of a 1 story, 180 x 240 ft. addition to truck factory. Estimated cost $100,000. Noted Nov. 1.

Ind., Evansville—The Ideal Dairy Co., 7th St. and Penn. Ave., is having preliminary plans prepared for the construction of a 2 story, 95 x 122 ft. addition to plant, including garage, repair shop, etc. Estimated cost $50,000. A. E. Neucks, 515 Peoples Savings Bank Bldg., Archt.

Ind., Evansville—The A. L. Maxville Co., 2nd and Vine Sts., awarded the contract for the construction of a 3 story, 50 x 150 ft. addition to garage and service station. Estimated cost $40,000. B. Diehl, Secy.

Ind., Indianapolis—The Bd. Public Wks. is having plans prepared for the construction of a 1 story, 50 x 105 x 200 ft. garage on New York St. Estimated cost $75,000. F. B. Hunter, State Life Bldg., Archt.

Ind., Laporte—The Motor Oil Garage plans to rebuild its garage and service station which was recently destroyed by fire. Estimated cost $60,000. Engineer or architect not selected.

Ind., Princeton—The B. Toney Motor Co. plans to rebuild its garage, which was recently destroyed by fire. Estimated cost $50,000.

Ia., Cedar Falls—The Viking Pump Co. is having preliminary sketches prepared for the construction of a 2 story, 66 x 132 ft. factory. Estimated cost $40,000. J. Ralston, L. & J. Bank Bldg., Waterloo, Archt.

Kan., Eureka—The Leader Garage & Motor Co. plans to build a garage. Estimated cost $100,000.

Ky., Ferguson—The Southern R.R. Co., Southern R.R. Bldg., Cincinnati, O., plans to build a 1 story, 100 x 130 ft. addition to its car repair shops, here. Estimated cost $75,000. A. A. Woods, Ch. Engr. Maintenance of Way and Structures.

Ky., Louisville—The Standard Sanitary Mfg. Co., 6th and A Sts., is receiving bids and will open same about Feb. 27 for the construction of a 4 story, 160 x 450 ft. brass finishing building on 7th St. Estimated cost $750,000. Joseph & Joseph, Francis Bldg., Archts. Noted Jan. 10.

Md., Baltimore — The Eastwick Motor Co., 120 West North Ave., will soon award the contract for the construction of a 2 story, 150 x 165 ft. garage, salesroom and service station on Remington and 29th Sts. Estimated cost $100,000. M. Koenig, Emerson Tower, Archt.

Mass., Dorchester (Boston P. O.)—The Natl. Can Co., 36 North Washington St., Boston, is having revised plans prepared and will receive bids in the spring for the construction of a 1 story, 120 x 160 ft. factory on Locust St., here. Estimated cost $150,000, including machinery. Krokyn & Brown, 7 State St., Boston, Archts.

Mass., Marlboro—H. H. Hazelton, 41 Chatham St., Worcester, is having plans prepared for the construction of a 1 story, 60 x 192 ft. garage on Main St., here. Estimated cost $40,000. J. Rice, 306 Main St., Worcester, Archt.

Mass., New Bedford—The city is having plans prepared for the construction of a 3 story, 152 x 226 ft. addition to school, including machine shop, on Country and Morgan Sts. Estimated cost $200,000. N. Ricard, 220 Municipal Bldg., Chn. Comn. Browne & Poole, 688 Pleasant St., Engrs. and Archts.

Mass., Worcester—The Royal Bed Spring Co., 7 Summer St., plans to build a 3 story factory. Estimated cost $40,000.

Mich., Detroit—The T. & R. Collins Trucking Co., 2539 Woodward Ave., is receiving bids for the construction of a 1 story, 60 x 115 ft. garage and repair shop on High St. Estimated cost $40,000. A. Des Rosiers, 620 McKerchey Bldg., Engr.

Minn., St. Paul—The Dept. Educ. will soon award the contract for the construction of a 3 story, 150 x 250 ft. junior high school with 2 story, 48 x 90 ft. wing, including shops, etc., on Blair and Lafond Sts. H. W. Austin, City Purch. Agt. F. X. Tewes, City Hall, Archt.

Mo., St. Louis—The Mendenhahl Motor Co., 2315 Locust St., awarded the contract for the construction of a 4 story, 37 x 155 ft. automobile service building. Estimated cost $100,000. Noted Dec. 13.

Mo., St. Louis—The St. Louis Steel Casting Co., 118 Malt St., awarded the contract for the construction of a 1 story, 80 x 116 ft steel foundry. Estimated cost $30,000.

Mo., St. Louis—M. Toder, 5370 Pershing Ave., awarded the contract for the construction of a 1 story, 75 x 280 ft. garage. Estimated cost $45,000.

N. Y., Binghamton—The Titchener Iron Wks., Frederick St., will soon award the contract for the construction of a 1 story plant on Griswold St. Estimated cost $50,000. R. Z. Spaulding, Pres. Private plans.

N. Y., Brooklyn—T. A. Digan, Inc., 656 3rd Ave., awarded the contract for the construction of a 2 story, 50 x 100 ft. foundry. Estimated cost $75,000.

N. Y., Buffalo—The Natl. Biscuit Co., 245 Urban St., plans to build a garage and repair shop. Estimated cost $45,000.

N. Y., New York—L. A. and M. Sheinert, c/o L. Sheinert, Archt., 194 Bowery, will build a 2 story, 150 x 200 ft. garage on Delancy St. Estimated cost $150,000.

N. Y., Schenectady—C. B. Christensen, 1628 Union St., will build a 1 and 3 story, 40 x 120 ft. and 40 x 60 ft. garage, etc. at 214 Clinton St. Estimated cost $110,000.

N. C., Charlotte—The Ford Motor Co., Highland Park (Branch of Detroit), Mich., awarded the contract for the construction of a 1 story, 301 x 800 ft. assembly plant, etc., here. Estimated cost $750,000.

N. C., Mebane—The White Furniture Co. will soon award the contract for the construction of a furniture factory, including 100 x 200 ft. machine shop, etc. W. E. White, Pres.

O., Bedford—L. Abrams, Engineers Bldg., Cleveland, had plans prepared for the construction of a 1 story and 2 story, 98 x 154 ft. garage on Main St., here. Estimated cost $60,000. G. Rudolph, Hunkin Conkey Bldg., Cleveland, Archt.

O., Cincinnati—The Lunkenheimer Co., 74th St., Carthage, manufacturer of brass goods, is having plans prepared for the construction of a 1 story, 300 x 400 ft. factory, including machine shop, etc. Estimated cost $300,000. H. Hake, Telephone Bldg., Archt.

O., Cleveland—The Bowler Fdry. Co., 1688 Columbus Rd., is having plans prepared for the construction of a 1 story, 200 x 500 ft. foundry on Newburgh St. along tracks of South Shore R.R. Estimated cost $200,000. J. H. Bruce, Pres. E. McGeorge, Stuyvesant Bldg., Archt.

O., Cleveland—The Cleveland Heater Co., 1900 West 112th St., is having plans prepared for the construction of a 1 story, 100 x 250 ft. addition to its factory. Estimated cost $200,000. L. Friedman, Pres. G. S. Rider & Co., Century Bldg., Archts.

O., Cleveland—The Foster Bolt & Nut Mfg. Co., 3556 East 72nd St., awarded the contract for the construction of a 1 story, 36 x 228 ft. addition to its factory. Estimated cost $50,000.

O., Cleveland—J. Kofron, 1823 East 55th St., awarded the contract for the construction of a 2 story, 50 x 100 ft. garage at 7724 Lexington Ave. Estimated cost $50,000.

O., Cleveland—The J. Roemer Heating Co., 1808 East 22nd St., is having preliminary plans prepared for the construction of a 1 story, 80 x 132 ft. addition to its factory. Estimated cost $40,000. W. S. Ferguson Co., 1900 Euclid Ave., Archts.

O., Cleveland—C. F. Thomas, 1478 East 116th St., plans to build a 2 story, 66 x 139 ft. sales room and garage on West 25th St. and Henninger Ave. Estimated cost $40,000. Engineer or architect not selected.

O., Cleveland—C. T. Tyler, 3127 East 80th St., awarded the contract for the construction of a 1 story, 40 x 136 ft. garage at 3169 East 80th St. Estimated cost $50,000. Noted Jan. 24.

O., Galion—The Galion Iron & Mfg. Co is having revised plans prepared for the construction of a 1 story, 50 x 160 ft. addition to its foundry. Estimated cost $65,000. Althous & Jones, Market Bldg., Mansfield, Engrs. Noted Oct. 4.

O., Lakewood—The Marked Motor Corp., 13316 Madison Ave., awarded the contract for the construction of a 2 story garage on Madison Ave. and Clarence St. Estimated cost $45,000.

Okla., Okmulgee—W. A. Sorg, c/o Chamber of Commerce, is having preliminary plans prepared for the construction of a 4 story, 40 x 40 ft. factory for the manufacture of gas engines. Estimated cost $50,000. Private plans.

Pa., Erie—The Erie Brass & Copper Wks., 18th and Washington Sts., plans to rebuild factory, which was recently destroyed by fire. Estimated cost $300,000. Engineer or architect not selected.

Pa., Latrobe—The Anchor Drawn Steel Co. is having plans prepared for the construction of a 1 story, 80 x 290 ft. and 50 x 120 ft. manufacturing building. Private plans.

Pa., Phila.—J. Kooperman & Son, 308 Florist Park, is having plans prepared for the construction of a 3 story, 56 x 84 ft. factory for the manufacture of copper kettles, tanks, etc., at 312-316 New St. Estimated cost $30,000. H. H. Kline, Bulletin Bldg., Archt.

Pa., Pittsburgh—The Federal Electric & Radio Corp., Park Bldg., plans to build a 1 story radio factory. Estimated cost $40,000.

Tenn., Etowah—The Louisville & Nashville R.R., 10th St. and Bway, Louisville, awarded the contract for the construction of a 1 story, 110 x 170 ft. machine shop here. Estimated cost $100,000. Noted Dec. 18.

Tenn., Knoxville — The Clinch-Locust Garage Co. awarded the contract for the construction of a 2 story, 100 x 250 ft. garage on Locust Ave. Estimated cost $75,000.

Tenn., Memphis—D. Dermon and A. Jett plan to build a garage and store building to contain 44,000 sq.ft. of floor space on South 3rd St. and Gaynor Ave. Estimated cost $75,000.

Tenn., Memphis—The Ford Motor Co., Highland Park (Detroit P. O.), Mich., awarded the contract for the construction of a 1 and 2 story, 300 x 800 ft. assembly plant, etc., on Riverside Blvd. and South Parkway, here. Estimated cost $1,250,000. Noted Dec. 20.

Tex., Houston—The Otis Elevator Co., 1617 McKinney St., awarded the contract for the construction of a machine shop. Estimated cost $40,000.

Utah, Holliday (Salt Lake City, P. O.)—H. Nielson is having plans prepared for the construction of a 1 story radio equipment factory, to contain 22,000 sq.ft. of floor space. Estimated cost $50,000. L. C Nielson, McIntyre Bldg., Salt Lake City Archt.

W. Va., Beckley—The Daniel Boone Mining Machine Co. is having plans prepared for the construction of a 3 story, 60 x 80 ft. machine shop. Estimated cost $50,000. Private plans.

Wis., Arcadia—Trempealean Co. plans to rebuild its machine shop for the repair of road machinery, which was destroyed by fire. Estimated cost $40,000. E. F. Rotering, Hy. Comr. Engineer or architect not selected.

Wis., Madison—J. Peterson, 102 South Orchard St., plans to build a 2 story, 60 x 200 ft. garage and repair shop on Fairchild St. Estimated cost $70,000. Engineer or architect not selected.

Wis., Milwaukee—The Pawling & Harnischfeger Vo., 38th and National Aves., is receiving bids for the construction and equipment of a 1 story, 182 x 400 ft. foundry for the manufacture of cranes and excavation machinery.

Wis., West Allis—The Mertz-Knippel Co., 6520 Greenfield Ave., is having plans prepared for the construction of a 1 story, 60 x 120 ft. garage. Estimated cost $40,000. R Allison, 425 East Water St., Milwaukee, Archt.